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ABSTRACT

Treatment approaches (a behavioral program including both contingency management instruction for parents and self-control training for children, or either drug therapy or contingency management, alone) were compared for effectiveness in dealing with eight hyperactive children (7-10 years old). A self-control curriculum composed of self-direction, motor inhibition, attending (paying attention), and social problem solving was instituted, along with a 20 hour behavior management program for parents. An intensive time-series design was used to assess the effects of the two interventions relative to drug therapy. All Ss who received treatment were simultaneously withdrawn from medication; another two served as delayed treatment control Ss--no attempt was made to alter their usual dosages of medication. Analysis of classroom observation and home behavior reports revealed that treated Ss displayed several patterns of change in classroom behavior. Two Ss were successful in withdrawing from medication, one S was withdrawn from 75% of original dosage without significant behavior change, another from 66% without change, and two from 50%. Ss displayed different responses to treatment on home behavior reports compared to school measures. Ss for whom behavioral treatment was most successful in controlling hyperactive behavior at school were not necessarily the same Ss showing the greatest improvement at home. Contrary to expectation, there was no evidence that self-control instruction for children added to the effects of child management classes for parents. Results suggested that behavior therapy is an effective alternative to drug treatment for a significant proportion of hyperactive children. (CL)

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FINAL REPORT

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Behavioral Alternatives to Stimulant Medication in Treating Childhood Hyperactivity: Effects on School and Home Behavior

by

Laurie A. Duckham-Shoor

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Chapter One

INTRODUCTION AND REVIEW OF THE LITERATURE

Hyperactivity in Children

Hyperactive children demonstrate a wide range of problem behaviors. They are excessively mobile and impulsive; they have unusually short attention spans and often do poorly in academics; and they consistently report having few friends and little self-esteem. Generally these problems begin in early childhood and persist without improvement for several years. Most frequently, there is no medical reason for the hyperactive child's abnormal behavior: he is neither neurologically nor psychiatrically impaired.

Hyperactivity is the most common behavior disorder of children today (Weiss & Hechtman, 1979). The percentage of elementary-aged children in the United States displaying the hyperactive behavior pattern described above ranges from one to fifteen percent (cf. Huessy, 1967; Huessy, Marshall, & Gendron, 1972; Stewart, Mendelson, & Johnson, 1973). An estimate of incidence, that is, new cases of hyperactivity per year, is not yet available in the literature.

Chapter One

INTRODUCTION AND REVIEW OF THE LITERATURE

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The variability in the prevalence estimates (1 to 15 percent) is a result of two factors. First, prevalence estimates depend on the type and number of referral sources. Teachers label three times more children hyperactive than do parents or physicians. Approximately five percent of all elementary-aged children are considered hyperactive by their teachers (Safer & Allen, 1976). A much lower incidence rate (1.2%) is obtained if all three referral sources, the parent, teacher and physician are required to concur on the diagnosis (Lambert, Sandoval, & Sassone, 1978). The subgroup of children for whom parent and teacher agree on the label hyperactive has been called "true hyperactives" by some research groups. Those children referred by either the school or the home, but not both, are designated "situational hyperactives" (Campbell, Endman, & Bernfeld, 1977). Prevalence figures will vary depending on whether so-called "situational hyperactives" are counted in the estimates.

A second reason for the variability in prevalence figures is the vagueness of the term hyperactive. No activity norms exist for children (Ross & Ross, 1976). Thus, there is no standard upon which to judge objectively if a child is hyperactive. Most often, the decision is a subjective one. Consequently, it varies depending on who is the decision-maker (Johnson & Prinz, 1976). For example, some teachers label a child hyperactive if he is generally a

problem in school. he cannot sit still, he does not finish his work, he cannot play cooperatively with others. Other teachers use the label if a child's behavior is highly disruptive and thus salient (Whalen, Henker, Collins, Finck, & Dotemoto, 1979). For example, even if these episodes are infrequent, boys who make car noises in class or fall over wastebaskets and desks might be called hyperactive. In these cases, labeling is based on the degree of commotion the child causes in the classroom rather than on the amount of activity he displays.

In an attempt to assist in precise diagnosis, Conners developed a global rating scale called the Teacher's Rating Scale to be used by teachers to quantify the degree of hyperactivity present in a given child (Conners, 1973). The Teacher's Rating Scale (TRS) consists of ten behaviors on which a child is rated from 0 (not at all) to 3 (very much). Any child who scores greater than fifteen on the TRS is considered hyperactive. Although the TRS is widely used in hyperactivity research (Barkley, 1977), its reliability and validity are questionable (Whalen & Henker, 1976).

Parents must rely on subjective judgments in deciding if their child is hyperactive. Many parents label their child hyperactive if he is more active than his siblings or playmates. But there is great variability in how tolerant parents are of active children. A child labeled hyperactive by one family might be considered to display a normal

activity level in another. Within a single family, one parent might consider a child hyperactive while the spouse does not.

Often, the final arbiter is the physician. He or she is the person who makes the formal diagnosis and prescribes the treatment. A physical exam and laboratory tests are part of a complete work-up for a child thought to be hyperactive (Mira & Reece, 1977). However, any "soft" neurological signs or electroencephalographic (EEG) abnormalities uncovered by these measures are generally not considered valid diagnostic signs by most physicians (Schmitt, 1975; Hart, Rennick, & Klinge, 1974: Capute, Niedermeyer, & Richardson, 1968; Sandoval, Lambert, & Yandell, 1976). Instead, physicians rely heavily on school and parental reports to formulate their diagnoses.

Sandoval et al. (1976) found that the majority of neurologists, psychiatrists, pediatricians, and general practitioners responding to a questionnaire consider <u>behavioral</u> rather than <u>physiological</u> data to be critical to their diagnosis. Of the eight most critical behaviors indicative of hyperactivity, six are obtained from the child's personal, school, and family history. The other two behaviors are evaluated on the basis of how the child acts during his physical exam. Although the physician appears to provide a third, <u>independent</u> evaluation of the child, in practice, this evaluation is clearly not independent. In

large part, the diagnosis is still made on the basis of subjective judgments of the child's parents and teachers.

Until a more precise, objective criterion to judge hyperactivity is developed, exact prevalence and incidence data are impossible to obtain. However, whether prevalence is the estimated low of 1% of all elementary children or the high of 15%, the fact remains that hyperactivity is the most common child psychiatric disabilility in this country today (cf. Safer & Allen, 1976; Sandberg, Rutter, & Taylor, 1978).

Current Treatment

Considerable disagreement exists, as discussed above, over what constitutes childhood hyperactivity. Must a hyperactive child display the full gamut of problem behaviors, that is, inattentiveness, learning impairment, misconduct, immaturity, impulsivity, peer difficulties, and low self-esteem? Or is one such behavior grounds upon which to diagnose him hyperactive? Must a hyperactive child be considered a problem by all who know him or can his hyperactivity be situation-specific (e.g., overly impulsive at school but not at home)? These questions remain moot despite the plethora of research articles published over the last two decades.

One area in hyperactivity research that has been less controversial, however, is treatment. Until recently, educators, parents and physicians have reached a general consensus: central nervous system stimulants are the

treatment of choice for the hyperactive child. Medication has been the most simple, inexpensive, and effective therapy to date (Safer & Allen, 1976; Wender, 1973; Eisenberg, 1972).

To illustrate the popularity of drug therapy, one need only look at the figures. Today, there are close to 700,000 school children taking central nervous stimulants such as methylphenidate hydrochloride (Ritalin) and dextroamphetamine sulfate (Dexedrine) to control their hyperactivity (Safer & Allen, 1976; O'Leary, 1980). Recently, a third drug, pemoline (Cylert), has recently been used successfully on hyperactive children. As yet, no statistic regarding the numbers of children taking this drug is available. Average duration of drug therapy is unknown, although it is common for a hyperactive child to begin taking stimulant medication in early childhood and stop treatment in adolescence (Ross & Ross, 1976).

Of the three most common drugs prescribed for hyperactive children, methyphenidate is the preferred stimulant (Sprague & Sleator, 1973; Krager & Safer, 1974). It is recommended that a physician begin prescribing this drug in small doses (e.g. 5 or 10 milligrams) once or twice per day. Dosages are then titrated, that is, gradually increased until the parent and/or teacher report a marked decrease in hyperactive behavior, or a maximum dose of 80 mg. is reached (Wender, 1973; Eisenberg, 1972). As a

guideline, the Physicians' Desk Reference (PDR), (1979) recommends a total daily dose of 1.0 milligram (mg.) per kilogram (kg.) body weight. For an average eight year old boy weighing 55 pounds, this would equal 25 mg. of methylphenidate per day. A dosage of 10-15 mg. per day is considered low, 20-30 mg. per day is considered average, and 40-60 mg. per day is considered high (PDR, 1979).

Physicians often adhere to the guidelines set forth in the Physician's Desk Reference. Yet research studies report findings based on samples of children whose methylphenidate doses vary greatly (Sulzbacher, 1973). One study reported a range of from 0.2 mg/kg to 2.6 mg/kg in its sample of 23 boys (Whalen, Collins, Henker, Alkus, Adams, & Stapp, 1978). How much stimulant medication is absorbed remains unknown; no research studies have assessed subjects to determine tissue or blood levels of the drug. Variability in dosages is problematic (Wolraich, 1977). Without consistent dose schedules, within-sample conclusions and across-sample comparisons become difficult.

Exactly how methylphenidate and the other central nervous system stimulants work to decrease hyperactivity is still unknown (Facts and Comparisons, 1980). For many years it was believed that stimulants had a paradoxical effect on hyperactive children. Whereas "normally" active people are energized by stimulants, hyperactive children were believed to be slowed down by these drugs. Physicians used the

so-called "paradoxical effect" as a diagnostic sign. If a child suspected to be hyperactive sat still more often and paid better attention in class while on stimulants, his hyperactivity was confirmed. If the stimulant did not increase his on-task and in-seat behavior, a diagnosis of hyperactivity was disconfirmed.

However, the paradoxical effect theory has been discredited on the basis of two important research findings. First, normal adults have been found to display improved concentration, increased alertness, and shortened reaction time when on stimulant medication (Weiss & Laties, 1962). Second, nonhyperactive children on methylphenidate have been found to react exactly as do hyperactive children (Rapoport, Buchsbaum, Zahn, Weingartner, Ludlow, & Mikkelsen, 1978; Shetty, 1971). These results suggest that perhaps hyperactive children are not physiologically different from others. Their response to stimulants is the same as that of normal adults and nonhyperactive children.

Currently, the most credible hypothesis as to why stimulants subdue hyperactive children is that the drugs arouse the inhibitory centers of the brain (Buchsbaum & Wender, 1973; Saletu, Saletu, & Itil, 1973; Barkley, 1977). The child on stimulant drugs is believed to be better able to <u>inhibit</u> his inappropriate impulses: he stops himself from getting out of his seat, looking away from his work, talking out in class. He is also more successful at

screening out irrelevant stimuli while on stimulant medication. Since impulsivity and distractibility are common characteristics of the hyperactive child, methylphenidate can greatly improve his behavior.

The Placebo Effect

How much a hyperactive child's improvement on stimulant medication can be attributed to the chemical action of the drug is unresolved. Since the primary symptoms of hyperactivity are behavioral rather than physiological, expectations can have a strong influence on whether a child improves during the course of drug therapy. Studies are beginning to incorporate double blind placebo treatments in their experimental design. Review of the research which employed placebo treatments to enhance experimental control shows that approximately one third of all hyperactive children decreased impulsivity and distractibility on placebo alone (Barkley, 1977; Sulzbacher, 1973). It is common to find studies reporting that the net effect of placebos is substantially greater than the effect of the drug itself (Knights & Hinton, 1969; Sroufe & Stewart, 1973). For example, in the Knights & Hinton study, teachers rated 88% of the methylphenidate group and 67% of the placebo group as improved. This finding suggests that placebo accounted for 67% of the improvement while the effects of the drug may have accounted for 21%, a much smaller portion. Because placebos demonstrate such a

powerful influence on hyperactive behavior, it is understandable that many consider double blind placebo treatment to be a minimum requirement in studies of drug effectiveness (Sprague & Werry, 1971; Wolraich, 1977; Sulzbacher, 1973).

Despite numerous unanswered questions regarding drug treatment, the use of stimulant medication to treat the hyperactive child is on the increase (Sroufe, 1975). Survey data from Baltimore County indicates that the percentage of children given stimulant medication for hyperactivity rose from 1.07% in 1971 to 1.73% in 1973 to 2.08% in 1975 to 2.12% in 1977 (Krager, Safer, & Earhardt, 1979). This rise might be attributed to the fact that in the 1960s and early 1970s, a multitude of short term drug studies appeared in the literature. Results from these studies were favorable on the whole and generated great enthusiasm for stimulant drug therapy (Weiss & Hechtman, 1979). However, more recently, numerous reviews of the effects of stimulant drug therapy on hyperactivity have tempered the early enthusiasm for drug treatment. Most notable are investigations by Sulzbacher (1973), Wolraich (1977), Whalen & Henker (1976), Sroufe (1975), and Barkley (1977). In general, these reviewers conclude that drug treatment is effective in controlling <u>some</u> of the symptoms of hyperactivity but not effective in controlling others. It is informative to clarify which aspects of the hyperactive behavior pattern

are affected by medication.

Effectiveness of Drug Therapy

Cognitive Performance Tests

Stimulant medication has been successful in improving the scores of hyperactive children on numerous laboratory type cognitive performance tests. The most frequently used measures are the Matching Familiar Figures Test (MFFT) (Kagan, Rosman, Day, Albert, & Phillips, 1964) and the Porteus Maze Test (Porteus, 1965).

The MFFT requires the child to look at a standard picture and six very similar-looking alternatives and choose the one picture which exactly matches the standard. Since the alternatives vary only in small detail, the successful strategy requires scanning all six alternatives in a systematic fashion before making a choice. Hyperactive children most often adopt an impulsive task approach. They choose the first alternative which looks the same as the standard without checking the other pictures to insure accuracy. On stimulant medication, the hyperactive child performs more reflectively. Typically, he takes longer to make his selection and makes fewer incorrect choices. Latency of response and number of errors both improve when the child is medicated. The effectiveness of stimulant medication at improving the MFFT performance of hyperactive children is well documented in the research literature (Rapoport, Quinn, Bradbard, Riddle, & Brooks, 1974;

Schleifer, Weiss, Cohen, Elman, Cvejic, & Kruger, 1975; Campbell, Douglas, & Morgenstern, 1971; Garfinkel, Webster, & Sloman, 1975).

The Porteus Maze Test is also sensitive to the effects of stimulant drugs on the hyperactive child. In this test, the child is required to draw a continuous line from the start to the finish of a maze without crossing any lines or entering any blocked paths (blind alleys). The test consists of a series of progressively more difficult mazes. Successful completion of each maze requires two strategies: slow, careful drawing so that no lines are hastily crossed, and frequent looking ahead so that no blind alleys are inadvertently entered. The test is considered a measure of attention span and concentration as well as the ability to plan, reason, and control impulsive responding (Barkley, 1977). As with the MFFT, the hyperactive child performs more skillfully on the Porteus Maze Test when he is on medication. The quantity of errors he makes is significantly lessened and the lines he draws are less wavy in quality. Almost every study using the Porteus Maze Test found it to be sensitive to the presence of stimulant medication in the hyperactive child (Rapoport et al., 1974; Conners, 1972; Conners, Taylor, Meo, Kurtz, & Fourier, 1972; Conners, Eisenberg, & Sharpe, 1964; Greenberg, Deem, & McMahon, 1972; Hoffman, Engelhardt, Margolis, Polizos, Waizer, & Rosenfeld, 1974).

In addition to the MFFT and Porteus Maze Test, stimulant medication has been shown to improve the performance of hyperactive children on tests measuring reaction time (Cohen, Douglas, & Morgenstern, 1971; Spring, Greenberg, Scott, & Hopwood, 1973; Sroufe, Sonies, West, & Wright, 1973; Sykes, Douglas, & Morgenstern, 1972), on the Continuous Performance Test which measures vigilance to task (Anderson, Halcomb, Gordon, & Ozolins, 1974; Sykes et al., 1972; Weiss, Minde, Douglas, Werry, & Sykes, 1971; Werry & Aman, 1975), on fine motor tasks requiring concentration (Knights & Hinton, 1969; Lerer, Lerer, & Artner, 1977) and on paired associate and other rote learning tasks (Dalby, Kinsbourne, Swanson, & Sobol, 1977; Conners et al., 1964.

While the above measures assess a variety of different skills, they have common elements. All require an ability to concentrate on the task at hand for several minutes at a time without becoming distracted by extraneous stimuli. In addition, most require the ability to plan and control one's response or to "stop, look and listen" before acting (Douglas, 1972). These two abilities, to concentrate and to inhibit impulsivity, appear to be most affected by stimulant medication. If the task requires a substantial amount of planning, vigilance or attention, the hyperactive child most probably will demonstate significant improvement when he is

on stimulant drugs.

Intelligence and Achievement Tests

For years it was assumed that stimulant medication promoted greater learning in the hyperactive child. Such an assumption was not unwarranted. Stimulants increase the hyperactive child's attention span and ability to resist distraction on performance tests; it was reasonable to expect better achievement on daily learning tasks. The following equation was widely accepted by teachers, parents and researchers alike:

Sitting Still + Paying Attention = Better Learning

However, in the early 1970s, reseachers started two new measurement strategies which later proved the equation to be invalid. First, they added standard measures of intelligence and achievement to the battery of laboratory performance tests. Second, they conducted long term evaluations of a child's academic progress while he was receiving drug therapy. Both measurement strategies resulted in some unexpected findings.

Measures of intelligence, the most common being the Wechsler Intelligence Scale for Children (WISC), have not shown that stimulant medication improves the IQ of hyperactive children. Although there have been exceptions (Conners, 1972; Hoffman et al., 1974; Weiss et al., 1971),

the majority of studies have found either that drugs have no effect, or that improvement is limited to isolated subtests. Of the nine double blind placebo studies reviewed by Wolraich, six showed stimulant medication to have no effect on the WISC (Wolraich, 1977). The only minimally consistent positive drug effect was improvement on the Coding subtest of the WISC (Sroufe, 1975; Spring, Yellin, & Greenberg, 1976). This test is a simple copying task requring sustained attention; it does not assess reasoning or problem-solving abilities. Since stimulants are highly effective when the task requires sustained attention, improvement on the Coding subtest is predictable.

Results of achievement testing tell a similar story: a hyperactive child who behaves more studiously on medication is not necessarily learning more. In seventeen short term studies measuring academic achievement over a median treatment period of six weeks, 82.6% of the dependent measures were not significantly improved by stimulants (Barkley & Cunningham, 1979). Generally, researchers used the reading, math and spelling subtests of the Wide Range Achievement Test (WRAT) as their dependent measures. The pattern of nonsignificant results was clear in studies employing a variety of other measures of academic achievement. In the small percentage of measures which showed stimulant medication to have a positive effect on short term achievement (17.4%), results were scattered and

inconsistent. Authors of the studies most freqently attributed these isolated improvements to enhanced attention and concentration during testing rather than to significant changes in intellectual and cognitive processes or scholastic performance (Barkley, 1977; Weiss et al., 1971; Conners, 1972).

It becomes clear that in the short run, stimulant drug therapy does little to improve the academic progress of hyperactive children. Several long term studies measuring school achievement over a period of years rather than weeks produce similar results. Despite treatment with stimulants, hyperactive children still have serious scholastic difficulties at follow-up (Minde, Lewin, Weiss, Lavigueur, Douglas, & Sykes, 1971; Huessy, Metoyer, & Townsend, 1974). Studies find that over 50% of the hyperactive children sampled failed at least one grade in school while undergoing drug treatment (Mendelson, Johnson, & Stewart, 1971; Weiss, Kruger, Danielson, & Elman, 1975). Other researchers report that despite drug therapy, hyperactive children do not demonstrate normal progress on annually administered achievement, intelligence and visual-motor tests (Weiss et al., 1975; Quinn & Rapoport, 1975). Generally, medication-treated children do no better than nontreated children on a variety of measures (Weiss et al., 1975, Riddle & Rapoport, 1976). On some academic measures, treated boys demonstated significant <u>decreases</u> in

performance as compared to non-medicated hyperactive controls (Riddle & Rapoport, 1976) or compared to their own pre-medication scores (Cunningham, 1973; Rie, Rie, Stewart, & Ambuel, 1976 a,b). Some teachers judged medicated children to be improved academically, but increased learning did not actually occur (Riddle & Rapoport, 1976).

Rie et al. (1976a) explain this discrepancy by suggesting that medication suppresses desirable and undesirable behaviors in children. Stimulants produce more in seat, on task behavior but at the same time, they reduce commitment to task and other facilitative behaviors. Evidence to support this explanation has recently been reported by Sprague and Sleator (1977). They compared the effects of various dosages of methylphenidate on the learning and behavior of hyperactive children. The optimal dosage of methylphenidate which decreased wiggling and increased positive teacher ratings was over three times the dosage which resulted in peak levels of learning.

Clearly, methylphenidate and other stimulants have different effects on different functions (e.g. Porteus Maze drawing versus reading comprehension). Clinicians should be aware that improved performance on some measures is not necessarily accompanied by improved academic performance. Indications are that teachers cannot rely on medication to treat the learning disabilities which so frequently

accompany hyperactive behavior.

Classroom Behavior

The effect of stimulant drugs on the behavior of the hyperactive child in school is generally measured using one of two methods: a global rating scale or a classroom observation system. Surprisingly, conclusions as to whether drug therapy improves a hyperactive child's classroom behavior depends in part on which measurement strategy is employed.

Rating scales. The vast majority of drug research with hyperactive children has utilized some type of rating scale for parents or teachers. Although there are several different scales filled out by teachers to assess changes in classroom behavior, the most widely used is the 39 item Conner's Teacher Rating Scale, TRS (Conners, 1969) or its shortened 10 item version, the Abbreviated Symptom Questionnaire, ASQ (Conners, 1973). To complete the TRS or ASQ, the teacher rates the degree to which the child displays a variety of hyperactive characteristics such as "fails to finish things he starts, short attention span" or "constantly fidgeting." A 4 point scale, ranging from "not at all" to "very much" is used. Items on the TRS or ASQ vary greatly. Some are global and others specific. Sometimes many different characteristics are grouped in one item (e.g., "excitable, impulsive") while other items include only one descriptor.

Virtually all research using the TRS or its abbreviated version has shown that the behavior of hyperactive children is substantially improved while on stimulant medication (Wolraich, 1977; Barkley, 1977). When a hyperactive child is taking medication, his score on the Teacher Rating Scale is significantly less than when he is not taking stimulants. In short, the TRS is highly sensitive to the presence or absence of stimulants in the hyperactive child.

This sensitivity, coupled with the fact that checklists like the Conner's TRS and ASQ are quick, easy and inexpensive to complete are probably why rating scales abound in the research literature. Of late, reseachers have recognized that in addition to the discriminative capabilities of rating scales, their reliability and validity must be assessed.

Studies show that rating scales of hyperactivity are unstable over time and that they result in low test-retest reliability coefficients (Werry & Sprague, 1974; Harley, Ray, Tomasi, Eichman, Matthews, Chun, Cleeland, & Traisman, 1978). The tendency is to score any child as less hyperactive the second time he is rated. This is a problem in drug studies comparing a hyperactive child's performance off medication to his performance on medication. Differences between pretest and post-test ratings cannot be attributed wholly to medication effects; caution must be used in their interpretation. Werry and Sprague (1974)

suggest that at least a portion of the difference in pre and post ratings is the result of a "practice effect."

Rating scales have the advantage of providing a global impression of behavior. This is in contrast to direct observations which focus on behavior only during a circumscribed segment of time. However, their global nature make rating scales more prone to rater bias. For example, a teacher or parent who hopes a given intervention will prove effective may be more likely to perceive it as effective and inadvertently skew ratings in favor of treatment (Sandoval, 1977). It is also difficult to obtain agreement between two adults rating the same child. Rarely do the ratings made by different raters produce an interrater reliability coefficient as high as .40 (Rapoport et al., 1974; Wender, 1971; Klein & Gittelman-Klein, 1975).

In addition to questions regarding reliability, the validity of rating scales has become a controversial issue. For a given measure to be considered valid, its results should converge with results from other data sources purportedly measuring the same construct (Cronbach, 1949). This is not always true for rating scales of hyperactivity. Often, scores obtained from checklists do not correlate with scores obtained from direct observations of hyperactive behavior. For example, Sprague, Barnes, and Werry (1970) found that teacher ratings on the Conners' TRS scale demonstrated a powerful effect of drugs on classroom

behavior even though there were few actual changes in the amount of deviant behavior recorded by observers. Others corroborate this lack of convergence between ratings and observations (Klein & Gillelman-Klein, 1975; Williams, Vincent, & Elrod, Note 1).

One research group designed a study to address the issue of validity of rating scales in hyperactivity research (Blunden, Spring, & Greenberg, 1974). They compared results on the Classroom Behavior Inventory, a rating scale very similar to the TRS, to observational data. Most of the relationships between corresponding inventory and behavior categories were low. For example, the correlation between rated and observed verbal expression was .17. Only one of the seven comparisons produced a significant correlation: rated and observed impulsiveness correlated .50).

However, an extensive study by Whalen and Henker indicates that perhaps rating scales <u>are</u> valid measures of hyperactivity. They compared teacher ratings on the Conner's Abbreviated Symptom Questionnaire to an observation system they designed. They found that 11 of the 21 observation categories correlated significantly with total ASQ scores; correlations ranged from .26 to .62 (Whalen et al., 1978). However, low interobserver reliability on the observation system makes interpretation of the results somewhat tentative. The highest correlations between observation category and ASQ score generally appeared in

categories requiring the observer to make subjective judgments. These same categories demonstrate some of the lowest interobserver coefficients. For example, four of the observational categories which showed the highest correlations with the total teacher rated ASQ score (i.e., "disruption", r = .62; "stand out", r = .51; "high energy", r = .44; "vocalization", r = .44) also have remarkably low interobserver reliabilities (.31, .36, .36, .38, respectively). Since most researchers train behavioral observers to a minimum reliability criterion of at least .75, any conclusions based on such below standard reliabilities are highly questionable.

Evidence to date leaves researchers questioning whether rating scales are a reliable and valid measure of the effectiveness of drug therapy (Sulzbacher, 1973). If a hyperactive child is rated by his teacher as improved on stimulant medication, it is unclear whether this improvement is a result of real drug effects, practice effects, subjective judgment, or the positive bias of the rater. Further, it is questionable whether the child's rated improvement would be supported by a different rater such as another teacher or confirmed by direct observations of the child's behavior in class.

Observational measures. To evaluate the effectiveness of drug and other therapies on the hyperactive child in a more direct manner, several researchers have turned to

classroom observations (e.g. Becker, Madsen, Arnold, & Thomas, 1967; O'Leary & Pelham, 1978; Gittelman-Klein, Klein, Abikoff, Katz, Gloisten, & Kates, 1976; Abikoff, Gittelman-Klein, & Klein, 1977; Campbell et al., 1977; Patterson, 1974). Using predetermined categories and the time sampling method, naive observers record the behavior of hyperactive and control children in naturalistic settings. Observation systems have the advantage of measuring the behavior expected to change as a result of intervention. Trends in behavior and differential effects of treatment on some behaviors but not others (e.g., on task but not fidgeting or blurting out) can be identified.

Direct observation requires taking an actual count of the frequency of a given behavior. It is considered by some methodologists to be the least inferential and most accurate measurement procedure (Siegel, 1956; Stevens, 1951). In a recent review of 756 studies of psychotropic medication and children, Sulzbacher (1973) found that only 3.8% used observational measurement. The others employed rating scales, performance tests, or clinical impression as their dependent measures.

Studies using direct observation to measure drug effectiveness are few in number; they are also conflicting in results. Several researchers have found that stimulants do <u>not</u> significantly reduce activity as measured by the number of times a hyperactive child leaves his seat or moves

away from his desk (Christensen, 1975; Schleifer, Weiss, Cohen, Elman, Cvejic, & Kruger, 1975; Sprague et al., 1970; Ellis, Witt, Reynolds, & Sprague, 1974; Whitehead & Clark, 1970). Other research groups have used observational measures and found that stimulant drug therapy is effective in decreasing hyperactivity (Gittelman-Klein, Abikoff, Pollack, Klein, Katz, & Mattes, 1980; Whalen et al., 1978).

As part of a larger study, Rachel Gittelman-Klein and her colleagues observed 21 children before, during, and following treatment with stimulant medication. They reported significant improvement in disruptive behavior and minor motor movement as a result of treatment. Their code was limited to five behavioral categories; it did not include interactive behaviors between the hyperactive child and others in his environment, such as teachers and peers. This limitation is noteworthy since the hyperactive child has been shown to be responsive to changes in teacher and parent behavior (O'Leary & Pelham, 1978; O'Leary, Pelham, Rosenbaum, & Price, 1976; Gittelman-Klein et al., 1976). Although data were collected on the child's behavior during treatment as well as pre and posttreatment, it was only for one sixteen minute observation period per week. Further, the total treatment lasted only eight weeks.

The most comprehensive observation system used to date is that developed by Whalen & Henker and their colleagues (Whalen et al., 1978). It consists of 21 categories of

behavior which are coded as present or absent two times per minute for twenty minutes per observation period. This system is an advance over previous codes in several respects. It samples the behavior of hyperactive children on a daily basis, in a variety of instructional settings and on a multitude of different behaviors. It also attempts to code the hyperactive child's behavior as it affects others in the environment. For example, the behavioral category "disruption" is coded whenever the target child's actions interrupt other people's ongoing behavior. Other interactive categories include "social initiation", "ignore", "physical contact" and "bystand". The Whalen system also tries to capture the quality of the hyperactive child's behavior in addition to frequency. Many codes require observers to make qualitative judgments, such as "sudden", "high energy", "stand out", "accidential" and "positive and negative verbalization". Because of its breadth, this observation system has the potential for adding new information to present data on hyperactive children. It could also be used to evaluate more completely the effect of stimulant medication on daily classroom behavior.

In a five week treatment study, Whalen et al. (1978) found that stimulant drugs significantly improved the behavior of hyperactive boys on seven of the 21 observation categories in their system. However, as discussed earlier,

these findings are difficult to interpret because interobserver reliabilities on this observation system were substantially lower than .75, which is the minimum figure generally reported in studies using observation systems (c.f. Abikoff et al., 1977; O'Leary & Pelham, 1978; Campbell et al., 1977; Williams et al., Note 1; Allyon, Layman, & Kandel, 1975). For example, of the seven behavioral categories in which a drug effect was manifest, only one category, "task attention", demonstrated a reliability at the conventional minimum. The mean occurrence agreement for the other six categories was calculated at .39 using a detection index and .63 using a concensus index. The authors offer several reasons why reliability is below standard on their observation system. Such explanations do not alter the fact that most researchers would not accept these results as reliable. Although a qualitative and interactive observation system is needed in hyperactivity research, if such a system cannot be used reliably, it sacrifices its informative value.

Summary of Drug Effectiveness Research

For every study demonstrating a positive effect of stimulant medication on the hyperactive child, there is another, equally controlled study which finds drug therapy to have no effect (Sulzbacher, 1973). The question arises: why the discrepancy? Do drugs work or not? There is no simple answer to this question. Whether one concludes that

drugs are beneficial to the hyperactive child depends in part on how one measures the drug's effects. In studies where laboratory performance tasks or behavior rating scales are used, stimulant drugs appear to decrease the symptoms of hyperactivity. In studies where achievement and intelligence tests are employed, stimulants seem to have little effect. In studies which employ a classroom observation system, results are mixed; no overall conclusions regarding the benefits of stimulant drugs on observed classroom behavior are possible. Future research must incorporate the full range of dependent measures in order to assess the total effects of stimulant medication on the behavior of the hyperactive child.

Side Effects

In order to fully evaluate the effectiveness of a drug, its risks as well as its benefits must be examined. The benefits of stimulant drug therapy for the hyperactive child are equivocal; the risks of stimulant medications are perhaps more clear.

Methylphenidate hydrochloride and dextroamphetamine sulfate are formally classified as Schedule II Substances by the Drug Enforcement Administration (DEA) of the United States Deparlment of Justice. Drugs in this schedule are described as having a high abuse potential with severe psychic or physical dependence liability (DEA, Note 2). Substances in Schedule II include non-narcotics such as

stimulants and barbiturates as well as narcotic drugs such as morphine and codeine. In short, methylphenidate and dextroamphetamine are not considered harmless medications by the government agency responsible for controlling their use.

Physiological Side Effects

There is no research evidence to show that the administration of stimulant drugs to hyperactive children results in physical addiction or dependence. However, methylphenidate and dextroamphetamine are known to have numerous physiological side effects. Many children experience insomnia, anorexia, irritability and depression while taking either of these stimulants (Barkley, 1977). Other less common side effects are dizziness, headaches, abdominal pain, nausea, lethargy and drowsiness, tremors, blurred vision and other ocular abnormalities, emotional sensitivity, and eneuresis.

In a sample of 155 hyperactives, parents systematically recorded side effects experienced by their children during the first weeks of methylphenidate treatment and again at the end of twelve weeks (Gittelman-Klein, Klein, Katz, Saraf, & Pollack, 1976). After four weeks, large percentages of children had mild to moderate problems falling asleep (67%), decreases in appetite (54%), difficulty arousing in the morning (23%), irritability (18%) and depression (16%). Percentages of children reporting these side effects decreased by the end of treatment, but

still remained moderately high. At the conclusion of the study, over one-third of the children were continuing to experience insomnia and/or loss of appetite at least four days per week. Likewise, Rapoport et al. (1978) found that over 60% of their normal sample of ten year old boys experienced insomnia after administration of methylphenidate. With some children, side effects are so severe that parents or physicians terminate stimulant medication, despite its positive effect on the behavior of the hyperactive child. In one case, 89% of the preschoolers given methylphenidate on an experimental basis, discontinued the medication at the conclusion of the study because of the intensity of the side effects (Schleifer et al., 1975).

Other physiological side effects attributed to stimulant medication are worrisome not because they are immediately negative or unpleasant for the child, but because of their long term harmful consequences. For example, researchers report that repeated stimulant usage can result in chronic increases in blood pressure (Arnold, Huestis, Smeltzer, Scheib, Wemmer, & Colner, 1976; Aman & Werry, 1975) and heart rate (Sprague & Sleator, 1977; Rie et al., 1976b; Cohen et al., 1971; Knights & Hinton, 1969). Probably the most controversial long term consequence of taking stimulants for several years is the suppression in childhood growth (Safer & Allen, 1973; Safer, Allen, & Barr, 1972; Beck, Langford, MacKay, & Sum, 1975; Quinn & Rapoport, 1975; Rie et al., 1976b).

Losses in height and, to a lesser extent, weight are worrisome for most parents and physicians. However, the issue of growth suppression is not clear (Roche, Lipman, Overall, & Hung, in press). Contrary to the above results, Millichap (1978, 1975) reports that stimulant medications do not have a depressing effect on growth. Most recently, a two year study of the effect of methylphenidate on height and weight showed that both measures of growth are adversely affected in the first year, but the height deficit is offset in the second year by a greater than expected growth rate (Satterfield, Cantwell, Schell, & Blaschke, 1979). These authors conclude that the temporary growth suppression in the first year is of such minor magnitude as to have little clinical significance. More long term studies of the growth rates of medicated hyperactive children are necessary before this conclusion can be accepted with confidence.

Psychological Side Effects

Stimulant drug therapy is a relatively simple solution to the problem of childhood hyperactivity. The underlying assumptions of this approach are: 1) there is something wrong with the child; 2) we must find out what is wrong and label it; and 3) the child must be given something to clear it up. Such a simplistic approach can have some negative psychological consequences for the child. He may learn that he is different from normal children, that he cannot control himself without taking special medicine, that he is

ultimately not responsible for his own actions (Ross & Ross, 1976). Such perceived loss of self-control may have a damaging impact on the child's self-esteem.

Once drug therapy is instituted, there is a tendency for teachers, parents and physicians to relinquish responsibility for treatment outcome. The school sees its responsibility as ended after it identifies the problem and makes the referral to the physician. The family's role is ended when the child is taken to the physician. The doctor's responsibility is fulfilled after organic disease is ruled out and a course of stimulant medication is prescribed. Once all parties have completed their duties, it is not customary practice to reopen the case to evaluate the results (Mira & Reece, 1977). Solomons (1973) found that 45% of the physicians surveyed monitored the medicated child's behavior less frequently than once every three months.

Although many parents and teachers originally choose medication as a short term solution to the problem, it often becomes a long term therapy. In many cases, once the child is put "on the pill", daily medication becomes the norm for the remainder of his childhood (Ross & Ross, 1976). Physicians in private practice who prescribe medication for hyperactive children and, <u>in addition</u>, recommend other treatments such as counseling or school consultation, find that parents seldom follow through with adjunctive therapies

(Sandoval et al., 1976). As one research group attempting to counsel parents phrased it:

> we found that the parents of a child who is being successfully treated with drugs are seldom very interested in analyzing their own behavior toward the child and trying to change it. (Schaefer, Palkes, & Stewart, 1974, p. 93)

In evaluating the effectiveness of stimulant medication for treatment of childhood hyperactivity, we must not overlook the ethical question: should stimulants be prescribed if there is a chance they could harm the hyperactive child? Most children experience unpleasant physiological side effects from these drugs and many develop "psychic dependence" on their medication. It is also possible that stimulant medications have long term consequences on growth, cardiovascular activity and self-esteem. The extensive list of side effects has caused many parents of hyperactive children much concern.

Alternative Treatments

Because of questionable benefit and frequent negative side effects, drug therapy has come under increasing scrutiny. Many believe that stimulant medication offers only symptomatic relief for hyperactivity (Wolraich, 1977). Drugs simply treat short attention span, distractibility and excessive motor activity but do nothing to cure the real problems which are academic and social in nature. As one

research group expressed it:

> we initially expected too much from any one drug or from any one method of treatment of hyperactive children... It was wishful thinking on our part that a useful drug alone would change the outcome of a fairly serious condition like severe chronic hyperactivity, with multiple etiologic factors and multiple and various manifestations. (Weiss et al., 1975, p. 164).

Due to growing dissatisfaction with drug therapy, alternative treatments have received much prominence in the research and lay literatures. Benjamin Feingold has proposed diet therapy, based on his hypothesis that hyperactivity is in large part an allergic reaction to artificial colorings and flavorings in food (Feingold, 1975). Others have suggested that hyperactivity is caused by fluorescent lighting and have recommended that the standard cool-white fluorescent lamps used in schools, stores, and offices be replaced (Mayron & Kaplan, 1976; Mayron, Mayron, Ott, & Nations, 1976; Mayron, Ott, Nations, & Mayron, 1974; Mayron, 1978). However, neither hypothesis has been clearly substantiated to date by research evidence. The number of diet responders has proven to be exceedingly low (Conners, Goyette, Southwick, Lee, & Andulonis, 1976; Williams, Cram, Tausig, & Webster, 1978) and attempts to replicate the original fluorescent lighting results by other researchers have failed (O'Leary, Rosenbaum, & Hughes, 1978a,b).

Behavior Therapy

The most promising alternative to drug therapy is

behavior therapy. This treatment generally involves teaching parents and/or teachers contingency management procedures. Compared to the volume of data on the treatment of hyperactive children with stimulant medication, the research on behavior therapy is limited. In spite of this paucity, results are generally consistent. Behavioral programs designed to reduce hyperactivity in children are successful, whether implemented by the parents at home (Bidder, Gray, & Newcombe, 1978; Dubey & Kaufman, 1978; Schaefer et al., 1974) or by the teacher at school (Rosenbaum, O'Leary, & Jacob, 1975; Pelham, 1977; O'Leary et al., 1976). TRS scores, parent ratings of hyperactivity on the Werry-Weiss-Peters Checklist, and other rating measures show significant decreases when a behavior management program is instituted.

Despite their apparent effectiveness, an important question still remains: how do behavior therapies compare to drug therapy in decreasing hyperactivity at home and at school on a variety of measures? Are programs which teach contingency management to parents and teachers a viable alternative to drugs or are they merely second rate treatments? Several studies have been conducted to address the relative effectiveness issue. In evaluating these studies, it is important to look at the thoroughness of the research design as well as the final outcome. More specifically, the following need be asked in order to evaluate results:

1. Do the subject selection procedures ensure that the children are "truly" hyperactive, (i.e., that they demonstrate the hyperactive behavior pattern across settings and times)?

2. Is the measurement strategy broad enough?

   a) Does it include observations in the classroom using a multi-category, interactive system on which adequate levels of reliability are attained?

   b) Does it include both home and school ratings of hyperactivity?

   c) Does it include measures of academic growth?

3. Is the study conducted over a long enough period of time to allow the effects of drug and behavioral treatments to become apparent?

4. Are the drug behavior therapies of sufficient quality as to provide a fair comparison?

Several of the most comprehensive research efforts comparing medication and behavior management will be reviewed in terms of their results and how adequately they satisfy the above criteria.

Gittelman-Klein et al. (1980) conducted an eight week study of children rated hyperactive on the Conners TRS and

considered hyperactive by their parents. Sixty-one subjects were randomly assigned to one of three treatments: methylphenidate alone, methylphenidate plus behavior therapy, or behavior therapy plus placebo. Each child's medication was gradually increased until the teacher reported that his behavior had improved. Daily doses ranged from 10 to 60 mg., with a mean of 38.2 mg. per day. Three measures were taken over the course of treatment: a weekly classroom observation using five behavioral categories, pre and posttreatment ratings on the TRS, and pre and posttreatment impressions of improvement made by each child's teacher, parents, and psychiatrist.

All three treatments resulted in significant clinical improvement on observational, rating and impressonistic measures. However, the magnitude of improvement varied across treatments. On all measures, boys in the methylphenidate plus behavior therapy treatment showed the most improvement. Closely following this group were the boys treated with methylphenidate alone. This second group's improvement was not significantly less than the first group's on six of the seven measures. Significantly less effective was the third treatment: behavior therapy plus placebo. Boys receiving medication with or without behavior therapy performed signifiiciantly better than boys receiving behavior therapy without any active medication.

One could conclude from the Gittelman-Klein et al. study that no matter how effective behavior therapy is, its success does not equal that of drug therapy. However, certain methodological shortcomings of this study require consideration before such a conclusion is reached. No assessment of academic progress was included in this study. In addition, it is possible that the eight week treatment period was not long enough to allow the comprehensive behavioral intervention to demonstrate its full effectiveness. Other criticisms include the infrequency of behavioral observation in the classroom (i.e. one time per week), and the impressionistic quality of the home and school measures of hyperactivity.

Two smaller scale studies resulted in findings almost exactly opposite to those of the Gittelman-Klein group. Experiments conducted by Christensen (1975) and Stableford, Butz, Hasazi, Leitenberg, and Peyser (1976) compared the effects of stimulant medication to behavior therapy using each subject as his own control. These studies found that behavior therapy combined with active or placebo medication produced significant improvements in a variety of measures including the TRS, observed classroom behavior, and academic productivity. The behavior management program was so successful at decreasing childhood hyperactivity that the additional use of methylphenidate was of little benefit.

The two within-subject studies deserve commendation for extending the standard 6-8 week treatment to 3 months. However, their measurement approach was not without fault: they lacked an assessment of hyperactivity at home and interactive observations in the classroom. Probably the most questionnable aspect of the Christensen study was its highly specialized subject population. It may not be valid to generalize from a sample of 13 institutionalized retarded hyperactive children to a nonretarded hyperactive sample living with their families.

Other studies with either single subjects or a small number of subjects report behavioral interventions to be successful at modifying a variety of hyperactive characteristics. Shafto and Sulzbacher (1977) found that for one hyperactive preschool child low doses of methylphenidate increased attending behavior during academic periods but food and contingent praise were more effective in decreasing activity changes, inappropriate talking aloud, isolated play and aimless wandering. At a higher dose, namely 1.0 mg/kg, the child's behavior deteriorated: his speech became less intelligible and his responsiveness to teacher questions during academic periods significantly decreased. Ayllon et al. (1975) measured both academic performance and classroom behavior of three hyperactive children for whom stimulant medication had a significant positive effect. Their results indicated that withdrawing

medication and replacing it with a token program which reinforced correct academic responses lowered disruptive classroom behavior to levels comparable to those attained on full medication. At the same time, math and reading performance for the three children jumped from 12% correct on full medication to over 85% correct using the reinforcement program with no medication.

Wolraich, Drummond, Salomon, O'Brien, and Sivage (1978) extended the Ayllon et al. experiment by studying the effects of drug and behavior therapies on 20 hyperactive children in standard classrooms. The effects of .3 mg/kg of methylphenidate and a token economy were compared; results revealed that either medication or behavior modification were successful at reducing undesirable classroom behaviors. Methylphenidate had a greater effect during individual seatwork while the token economy was more powerful during group instruction. However, only behavior modification resulted in improved scholastic achievement. These findings confirm the results of the smaller scale studies; behavior and drug therapies are equally effective in promoting better classroom behavior. A behavioral approach may be more effective in producing increased learning.

Another study which addressed the relative effectiveness question was conducted by O'Leary and Pelham (1978). Their methodology was very complete: subject selection procedures were thorough; behavior was measured at

home and at school; drug and behavior therapies were of standard quality; and the four month treatment was far longer than the mean duration of previous studies. Design shortcomings were in the area of dependent measures: only a single category of classroom behavior and no academic measures were used. In this study, seven hyperactive children on stimulants were gradually withdrawn from their medications concomitant to implementation of home and school behavior management programs. Unlike the single subject design studies reviewed above, O'Leary and Pelham grouped the data from their seven subjects. By grouping results, behavior therapy appeared to be as effective as stimulant medication in reducing off task behavior; the pretreatment mean for off task (while on full medication) was not significantly different from the posttreatment mean (while on no medication). However, a closer look at individual data reveals that three of the seven subjects showed greater levels of off task behavior at posttesting than at pretesting. That is, for nearly half their sample, behavior therapy did not prove to be as effective as drug therapy.

Which therapy is most effective in improving childhood hyperactivity? Findings from the studies reviewed here are somewhat disconcerting to those looking for a simple answer to this question. There appears to be great variability in how children react to behavior management and stimulant medications. For some children, a behavior management

program for their parents and teachers results in significant improvement in their behavior. For others, only medication produces change. Since studies demonstrating the effectiveness of behavior therapy are few and the total number of subjects small, the balance remains tipped toward stimulant medication as the treatment of choice. Some researchers have questioned whether another behavioral treatment could be more effective than parental training in contingency management. As a result, there has been a flurry of interest in self-control training as a treatment for hyperactivity.

Self-Control Instruction

As early as 1968, people began studying the effects of teaching hyperactive children how to better control their own behavior. One group found that the hyperactive child's impulsive style of problem-solving could be modified if he learned how to tell himself to listen to directions, slow down, and think before he answered (Palkes, Stewart & Kahana, 1968; Palkes, Stewart & Freeman, 1972). Others have found they could improve a hyperactive child's performance on a variety of tasks if he were taught how to plan his task approach, guide himself through task completion, encourage and reward himself, and lead himself back after making an error (Meichenbaum & Goodman, 1969, 1971; Weithorn & Kagen, 1979). In laboratory-type studies, instruction in self-directed verbalization has been successful with

hyperactive children as measured by the Porteus Maze Test, the MFFT, and subtests of the WISC. Whether self-instruction training would effect behavior outside of the laboratory was unknown until Bornstein & Quevillon (1976) designed a study to assess generalization of self-verbalization to classroom behavior. In this study, three overactive four year old boys were taught how to self-instruct on experimental tasks using a procedure similar to that of Meichenbaum and Goodman. These children were then observed in their regular classrooms and found to be markedly more on task immediately after training as well as twenty weeks later at follow-up. Data from a study with a similar population provided partial support for these results (Arnold & Forehand, 1978). However, a replication study conducted with seven and eight year old children did not confirm the Bornstein and Quevillon findings (Friedling & O'Leary, 1979). Self-instruction with this group did not have even an immediate effect on either academic performance or on task behavior. Because the self-instruction program failed to produce results, a token economy program was implemented in this study. Contingency management proved to be highly successful at modifying on task behavior.

In addition to teaching hyperactive children to control their own cognitive behavior, researchers have also attempted to teach self-management of motor behavior with some success. Ross and Ross (Note 3) used discrimination

training to teach one hyperactive boy how to adjust the speed of his performance to the requirements of the task. At the end of treatment, he demonstrated age-appropriate control of his motor responses. McMahon and Sulzbacher (1980) report a preliminary study of relaxation training with a hyperactive child in which relaxation also shows promise at decreasing inappropriate classroom behavior. Generally, results from self-control research with hyperactive children are encouraging. However, much of these data come from isolated studies conducted under laboratory conditions using single dependent measures.

An exception to the above limitations is the work of Virginia Douglas at McGill University. She and her colleagues have conducted the one comprehensive effort to teach hyperactive children a variety of self-control skills and assess the effectiveness of this instruction on a wide range of dependent measures (Douglas, Parry, Marton, & Garson, 1976). The Douglas group developed a cognitive training program that attempted to teach hyperactive children to control their attention and impulsivity using modeling, self-verbalization, and problem-solving strategies. In addition to intensive instruction for the child, parents and teachers were introduced to behavior management techniques and taught how to help their child become a more self-controlling individual. Following training, hyperactive children performed significantly

better than untrained controls on a battery of tests including the MFFT, Bender-Gestalt, and Durrell Analysis of Reading Difficulty. Trained children also performed significantly better at posttesting than they did at pretesting on nine of the ten dependent measures; these improvements were maintained at three month follow-up.

Whether these cognitive gains resulted in actual behavior change is unknown since observations of children in naturalistic settings were not undertaken. This cognitive training program is notable because it taught hyperactive children a variety of self-control skills in a direct fashion and included parents and teachers in the training. However, it failed to assess how well the skills taught and measured in the laboratory generalized to the home and the classroom. This criticism is of some import considering the Friedling and O'Leary (1979) finding that self-instruction training in the laboratory setting had no effect on classroom behavior. The Douglas study also did not compare a self-control program with drug therapy. Without this comparison, self-control training cannot be considered a clinical alternative to stimulant medication. The Douglas group realized these limitations and called for large scale studies to evaluate relative and combined effectiveness of cognitive training, contingency management, and pharmacological treatment. To date, no such comprehensive

studies have been undertaken.

Research Objectives

This review has pointed out several limitations in current research on childhood hyperactivity. In summary, they are:

1. The lack of a wide range of measures to assess changes in the numerous characteristics of the hyperactive behavior pattern.

2. The predominance of laboratory measures rather than naturalistic measures of treatment effects.

3. The use of a short treatment period of insufficient length to explore fully the positive and negative effects of behavioral and drug treatments over time.

4. The lack of studies comparing the effectiveness of behavior management instruction, comprehensive self-control training, and stimulant medication.

The present study was designed to address these shortcomings. The overall research objective was to determine in what ways a behavioral treatment which included both contingency management instruction for parents and self-control training for children was more or less effective at decreasing hyperactivity than either drug therapy or contingency management alone. In order to

measure relative effectiveness of these three treatments, a naturalistic eighteen week study was conducted in which eight hyperactive boys were assessed on a full range of measures at home and at school. Some measures were taken daily and some were taken pre and posttreatment. Included in the assessment battery were classroom observations using a reliable, interactive coding system, teacher ratings of hyperactive behavior, parent counts of negative behavior at home, achievement and intelligence tests, cognitive performance tests, a self-esteem test, and measures of height and weight. It was felt that a study of this breadth could begin to answer the questions brought to light in this literature review.

Chapter Two

METHOD

Subject Selection Procedures

Rationale for Screening

Hyperactivity research has burgeoned in recent years. More than 2000 articles and 5 books have been devoted to various aspects of the problem (Weiss & Hechtman, 1979). Despite this spurt of new research, few conclusions about the effects of treatment can be drawn. This is due to a variety of methodological problems, most notably in the area of subject selection. Three of the most serious shortcomings include variability between samples of hyperactive children, variability within the same sample of children, and failure to affirm positive drug response in comparative treatment studies.

The first problem, variability among samples of children selected for study, is especially pervasive (Wolraich, 1977; Sulzacher, 1973; Sroufe, 1975; Sandoval, 1977). Some researchers have focused on children who exhibit hyperactive behavior at home and at school while others have studied children who are hyperactive in only one setting. Some studies select subjects on the basis of their scores on subjective rating scales (cf. Conners TRS, 1969).

Others use a physician's diagnosis of Minimal Brain Dysfunction as the main criterion for inclusion. A few studies use more rigorous behavioral observations to screen out normal, active children from the subject pool. These varying methods of choosing subjects result in two problems. Children selected by one research group are often not considered hyperactive by another, and treatments that have proven effective with one sample of "hyperactive" children may not prove effective with another.

An associated methodological problem in subject selection procedures is within-sample variability. Even when children are selected for a single study using the same methods, they may differ greatly from one another. For example, one child's hyperactivity may center around problems getting along with peers while another's may relate more to attention to task. These differences are understandable considering the fact that different parents, teachers, and physicians evaluate each child, and each may use different criteria. However, within-sample variability may mean that treatments may be effective for one subsample of hyperactive children but not for another. Grouping subsamples may obscure differential treatment effects.

A third methodological problem arises in studies comparing the effects of drug therapy to other treatments. In order to demonstrate that a given treatment is as

effective as medication in controlling hyperactivity, it must be clear that medication does in fact have an effect on the behavior of subjects selected for study. Just because a child's behavior improves on medication does not guarentee that the drug is responsible. In many cases improvement can be attributed to a placebo effect. It is estimated that 39% of all positive responses to stimulant medication are no more than placebo (Barkley, 1977). This suggests that double blind placebo trials are a necessary step in screening for comparative treatment studies.

To resolve these three methodological problems, an extensive screening procedure was designed. Its objectives were the following:

1. Children selected for study would be considered hyperactive by multiple selection criteria;

2. The sample would be as homogeneous as possible with respect to age, severity, and behavioral characteristics; and

3. Children selected for study would show a positive response to their current medication during double blind placebo trials so that meaningful comparisons between drug therapy and behavioral treatments would be possible.

An overview of all screening procedures is presented in

Figure 1.

Phase One--Recruitment and Preliminary Screening

This study involved the withdrawal of hyperactive children from stimulant medication. Consequently, parents of hyperactive children were the targets of recruitment efforts as it was felt that administration of drugs was a parental decision rather than a school decision.

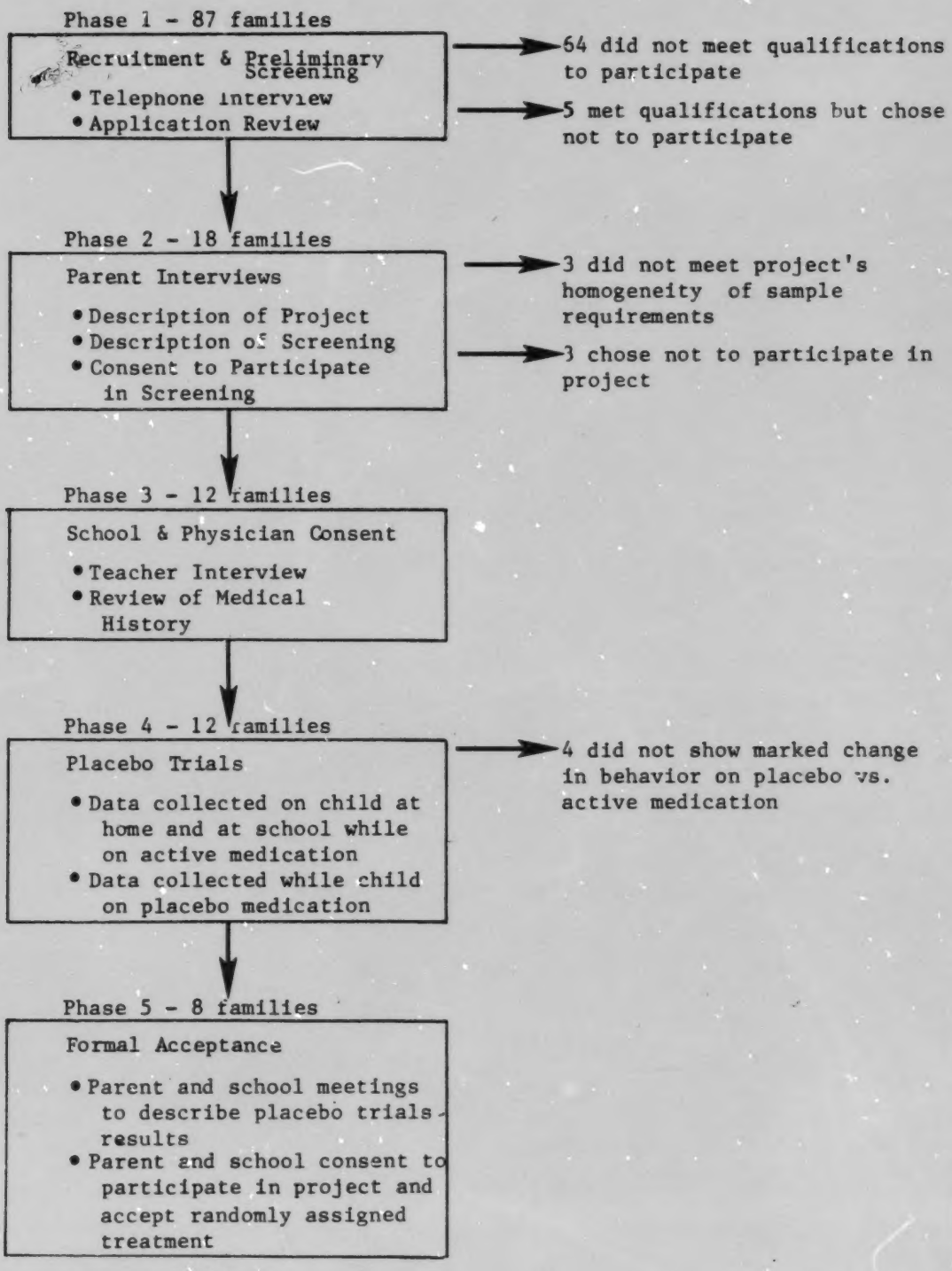
Hyperactive children and their families were recruited for this study from a 35 mile radius of Stanford University. Advertisements were run in four local newspapers covering two counties. Letters describing the project were also sent to 69 elementary school principals. Enclosed were flyers to be distributed to parents of boys who were known to be taking stimulant medication (Appendix A). In addition, articles describing the project appeared in three local newspapers, a medical center news release, and a parent newsletter sponsored by the California Association for Neurologically Handicapped Children (CANHC). These efforts yielded a total of 87 telephone inquiries.

A staff of five undergraduate research assistants were trained to describe the project and conduct interviews with interested parents over the telephone (Appendix A). The purpose of these interviews was to identify those children who met the following preliminary criteria:

1. Boys between the ages of seven and eleven years old.

Figure 1

Diagram of Subject Selection Process


Phase 1 - 87 families
Recruitment & Preliminary Screening
• Telephone Interview
• Application Review
64 did not meet qualifications to participate
5 met qualifications but chose not to participate
Phase 2 - 18 families
Parent Interviews
• Description of Project
• Description of Screening
• Consent to Participate in Screening
3 did not meet project's homogeneity of sample requirements
3 chose not to participate in project
Phase 3 - 12 families
School & Physician Consent
• Teacher Interview
• Review of Medical History
Phase 4 - 12 families
Placebo Trials
• Data collected on child at home and at school while on active medication
• Data collected while child on placebo medication
4 did not show marked change in behavior on placebo vs. active medication
Phase 5 - 8 families
Formal Acceptance
• Parent and school meetings to describe placebo trials results
• Parent and school consent to participate in project and accept randomly assigned treatment

2. Currently taking stimulant medication to control hyperactive behavior.

3. Of normal intelligence and attending public school.

4. Hyperactive both at home and at school.

5. No gross neurological disease, psychosis, or other physiological cause for hyperactive behavior.

Parents of children meeting these criteria and interested in participating in the project were sent applications and scheduled for a personal interview with one of the Project Co-Directors (Appendix A). Eighteen families progressed to Phase Two of screening.

Phase Two--Parent Interviews

Structured parent interviews lasting approximately 2-3 hours were conducted at Stanford University. Both parents participated in these sessions. In order to facilitate communication, parents were asked not to bring the hyperactive child with them. Parent interviews had several objectives:

1. To review in detail the application to participate in the project and to confirm that the hyperactive child met preliminary screening criteria.

2. To describe the proposed treatments in detail including the requirements that parents accept random assignment to treatment and agree to withdraw their child from medication.

3. To obtain signed parental releases to allow Project Co-Directors to obtain information on the hyperactive child from his school and physician (Appendix A).

4. To describe Phase Four of screening, placebo trials, and to obtain written consent to observe the hyperactive child at school and at home while he is on active medication and placebo (Appendix B).

5. To gather more information on problems parents have with the hyperactive child at home using a Q-Sort technique. A summary of the items used in the Q-Sort can be found in Appendix B. The ten most bothersome behaviors identified by this method became items on the Home Behavior Report.

Of the eighteen sets of parents interviewed, three couples chose not to participate in the project. Their reasons included not wanting to withdraw their child from medication, not being willing to attend weekly child management classes, and not wanting to ask the teacher for

any additional help with their child's behavior problem. An additional three sets of parents were dropped from further screening because either the amount of medication, the type of medication or the frequency of drug administration varied considerably from the rest of the sample. The twelve children who participated in further screening were the most homogeneous of the applicants.

Phase Three--School and Physician Consent

Meetings were scheduled with the teachers of each of the twelve perspective subjects. The purpose of these meetings was to inform each teacher about the project and the screening procedures and to obtain their cooperation in four vital areas:

1. Agree to allow observers in the classroom during placebo trials and for three days per week throughout treatment.

2. Identify at least two academic and two social behaviors the hyperactive child had difficulty with at school. These behaviors became items on the daily School Note (Appendix B).

3. Agree to complete daily School Notes during placebo trials and throughout the study.

4. Agree to allow the child to receive self-control instruction from project staff during regular

class time if he was randomly assigned to this treatment.

All twelve teachers agreed to these conditions.

Each child's pediatrician was also sent written material describing the project along with a telephone number to call to obtain more information if he so desired. Also enclosed was a request for information on the medical history of the hyperactive child (Appendix A). All physicians returned this information; its review showed that no prospective subjects displayed hyperactivity secondary to gross neurological disease, psychosis, or other physiological causes.

On the basis of information received from teachers and physicians, all twelve children advanced to Phase Four of the screening process.

Phase Four--Placebo Trials Design

A ten day double blind placebo study was conducted to ensure that active medication was effective in controlling the behavior of the twelve hyperactive children under consideration. This procedure has been used by other investigators to screen out children for whom medication is not effective (O'Leary & Pelham, 1978; Allyon et al., 1975). For example, O'Leary and Pelham (1978) disqualified two of their ten potential subjects because behavior on and off medication failed to differ significantly.

Two different designs were implemented in the placebo trials depending on the medication the child was taking (See Figure 2). The nine children on methylphenidate were given active medication for four days, placebo for four days, and active medication for an additional two days. The three children taking pemoline were given active medication for four days and placebo for the remaining six days. These two designs were necessary because the half-lives of the two drugs differ (Physicians' Desk Reference, 1979). In 24 hours all but one percent of the amount of methylphenidate taken has left the bloodstream whereas with pemoline, it takes 72 hours to reach this same percentage. Therefore, only a one day "washout" period was required for the children on methylphenidate whereas a three day "washout" was required for children taking pemoline. Data collected during these washout periods were considered part of the active medication phase.

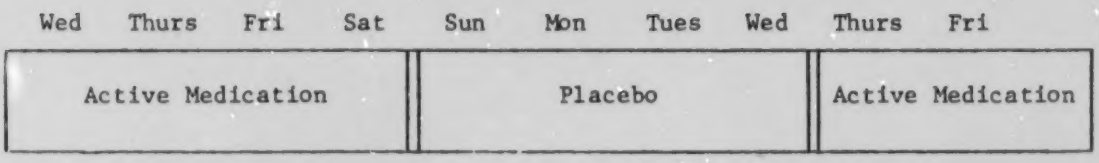
Medication Protocols

Both active and placebo medications during this ten day period were supplied to parents by the project pediatrician. These medications were prepared by the pharmacy at the Stanford University Medical Center. Active medication and placebo looked identical; both were enclosed in capsules containing a charcoal additive to disguise any differences in color or taste.

Figure 2

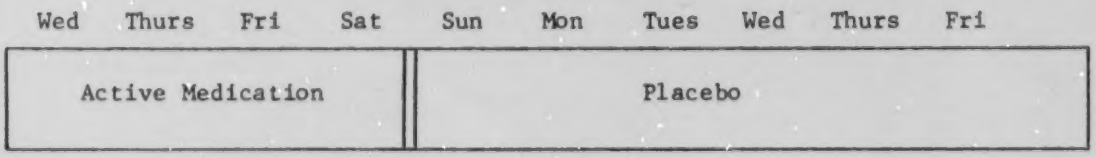
Placebo Study Designs

Methylphenidate (Ritalin) (N = 9)



24-hour drug "washout"

Magnesium Pemoline (Cylert) (N = 3)



72-hour drug "washout"

All children took medication in the same dosages and at the same times each day as they had prior to the start of the placebo trials. Each capsule was put in a separate envelope and labeled as to the date and time to be taken. Capsules to be taken by the child at home were given to parents along with complete instructions for their administration (Appendix B). Capsules to be taken at school were placed in a separate packet with accompanying instructions and delivered by the parent to the person responsible at school (Appendix B). All parents and school personnel complied fully with project instructions.

Data Collected

Three types of data were collected daily during placebo trials: Classroom Observations, School Notes, and Home Behavior Reports.

Classroom Observations were conducted by nonparticipant observers using the Hyperactive Behavior Observation System (HBOS) (Kirmil-Gray & Duckham-Shoor, Note 4). Observers were blind to the purpose and design of screening. Each day an observer coded the behavior of the target child and three randomly selected boys in the same class (comparison children). A complete description of the observation code and procedures is presented in the Dependent Measures section of this report.

From observational data, a Negative Behavior per Minute score (Negbeh) was calculated for the target child and for

the composite comparison child (CNegbeh). These two scores were subtracted from each other to yield a Difference Score (Dscore) as follows:

Negbeh - CNegbeh = Dscore

3.41 - 4.41 = -1.00

Using this formula, any positive Difference Score indicated that the target child displayed more negative behaviors per minute than other children in the class. Conversely, a negative Difference Score indicated that the target child displayed fewer negative behaviors than his classmates. If medication was effective in controlling the behavior of the hyperactive child, Difference Scores should have shown two patterns. First, Difference Scores in the placebo phase should have been markedly higher than scores in the baseline phase (greater than 20%). Second, scores while the child was on placebo should have been positive in sign and greater than +1.0, indicating that the target child was considerably worse than others in his class during this phase.

School Notes were completed by the target child's teacher at the end of each school day. All twelve teachers were blind to the amount of medication the child in their class was taking. Each of the teachers rated the four or five behaviors she had identified previously as problems for

the child. Ratings ranged from 1 to 5 on each behavior for a total score of 5 to 25 points. If the child's medication was effective, his School Note scores should have dropped markedly during the placebo phase (more than 20%).

Parents completed Home Behavior Reports at the end of each day. As with teachers, all parents were blind to the exact amount of medication their children were taking. They were informed that the dosage could range anywhere from no medication to no higher than the child's current amount. Each Home Behavior Report consisted of ten items selected by parents as specific problems for their child. Parents recorded the frequency from 0 to 4 of these ten behaviors on a daily basis. Total scores ranged from 0 to 40. If medication had an effect on the child, it was expected that Home Behavior scores would show a sharp increase during the placebo phase (greater than 20%).

Each of the three measures used to collect data during screening are fully described in the Dependent Measures section of this report.

Results of Placebo Trials

Data for the twelve subjects involved in the placebo trials is presented in Table 1. A scoring system was developed to simplify and summarize the screening data and to aid in subject selection (Tables 2 and 3). Variables rated were Classroom Observations, School Notes, Home Behavior Reports, School Cooperation, Parent Cooperation,

Table 1

Classroom Observation, School Note, and Home Behavior Report Scores During Placebo Trials

Rank Order	Subject	Classroom Observations[a]			School Notes			Home Behavior Reports		
		Baseline	Placebo	Baseline	Baseline	Placebo	Baseline	Baseline	Placebo	Baseline
1	Scott B.	.47	1.32**	----[b]	18.0	7.5**	----[b]	13.75	19.0**	10.25
2	Wade	1.41	4.15**	1.54	11.0	7.2**	14.5	15.8	30.3**	16.5
3	Eric G.	-.69	1.81**	-.10	15.6	11.7**	23.0	12.0	10.0	6.0
5	Chris	-3.72	.20**	-.81	16.25	7.0**	22.5	6.0	18.75**	7.0
5	David	-.63	-.61	-3.08	16.3	8.3**	18.0	11.3	17.3**	6.0
5	Jason	2.10	2.84**	2.30	14.58	12.08*	16.25	17.0	20.5**	10.5
7.5	Eric C.	-.50	2.62**	.67	14.2	8.6**	21.6	8.0	6.0	5.3
7.5	Scott S.	-.66	2.16**	----	10.6	6.3**	----	14.0	14.7	----
9	Steve	-.74	-.15**	----	20.4	16.9*	----	16.2	7.5**	----
10	Tom	-.15	.82**	----	16.3	13.3	----	5.0	5.5*	----
11	Paul	-1.91	-.77**	-1.01	19.5	11.7**	17.5	7.0	4.3	7.5
12	Robbie	-.22	-.88	----[b]	23.3	21.5	22.0	22.5	21.8	21.5

Note. "**" indicates a 20% increase or decrease in scores

"*" indicates a 10% increase or decrease in scores

[a] Difference Scores

[b] No data available due to illness of child or observer

Table 2

Subject Ranking Criteria

1. CLASSROOM OBSERVATIONS

Pattern One--Baseline vs. Placebo

2 = Increase in scores during placebo phase greater than 20%
1 = Increase in scores during placebo phase greater than 10%
0 = Increase in scores during placebo phase less than 10%

Pattern Two--Target Child vs. Classroom Controls

1 = Scores during placebo phase greater than or equal to +1.0, indicating that the target child is more disruptive than comparison children
0 = Scores during placebo phase less than +1.0, indicating that the target child is as disruptive or less disruptive than comparison children

2. SCHOOL NOTES

2 = Decrease in scores during placebo phase greater than 20%
1 = Decrease in scores during placebo phase greater than 10%
0 = Decrease in scores during placebo phase less than 10%

3. HOME BEHAVIOR REPORTS

2 = Increase in scores during placebo phase greater than 20%
1 = Increase in scores during placebo phase greater than 10%
0 = Increase in scores during placebo phase less than 10%

4. SCHOOL COOPERATION

2 = No problems anticipated
1 = One or two slight problems anticipated
0 = Many problems anticipated (e.g. securing room, working with principal, allowing observers in classroom, completing School Notes, scheduling, not supportive of program)

5. PARENT COOPERATION

2 = No problems anticipated
1 = One or two slight problems anticipated
0 = Many problems anticipated (e.g. spotty attendance at meetings, family instability, infrequent child contact, unreliable about returning data, not supportive of program)

6. DOSAGE OF MEDICATION

2 = Currently takes over 1.0 mg/kg body weight
1 = Currently takes between .30 and .99 mg/kg body weight
0 = Currently takes less than .30 mg/kg body weight

Table 3

Subject Ranking

Subject	Classroom Observations: Pattern 1 Baseline vs. Placebo	Classroom Observations: Pattern 2 Target vs. Comparison	School Note	Home Behavior Report	School Cooperation	Parent Cooperation	Dosage of Medication	Total	Rank
Scott B.	2	1	2	2	2	2	2	13	1
Wade	2	1	2	2	1.5	1.5	2	12	2
Eric G.	2	1	2	0	2	2	2	11	3
Chris	2	0	2	2	2	1	1	10	5
David	0	0	2	2	2	2	2	10	5
Jason	2	1	1	2	2	0	2	10	5
Eric C.	2	1	2	0	2	1.5	1	9.5	7.5
Scott S.	2	1	2	0	2	1.5	1	9.5	7.5
Steve	2	0	1	2	1	2	1	9	9
Tom	2	0	0	1	2	2	1	8	10
Paul	2	0	2	0	1	1	1	7	11
Robbie	0	0	0	0	2	2	1	5	12

and Dosage of Medication. On the basis of these ratings, subjects were rank-ordered for inclusion in the study. Eight out of the nine top-ranked children were chosen. One potential subject, Jason, ranked fifth in overall ratings, but was dropped from further consideration after additional consultation with his parents made clear that they would be unable to attend weekly parent classes.

Phase Five--Formal Acceptance

Interviews were scheduled with the parents of the twelve children who participated in placebo trials. Data from screening were reviewed, and reasons for acceptance or nonacceptance in the study were explained. The four families who were unable to be treated in this study were referred to appropriate community services. The eight families who were selected had the requirements of the project again described to them. They were then asked to sign an individualized contract with the Project Co-Directors which specified the exact terms of their participation as well as a Consent to Participate in the Self-Control for Kids Project (Appendix C).

Meetings with the teachers and principals of the eight subjects were also held to review the data from screening and to obtain final approval for involvement in the project. Cooperation was insured by all eight schools.

Following formal acceptance, subjects were randomly assigned to treatment, and data collection procedures were

begun.

Subject Characteristics

Descriptive data on the eight subjects in this study are presented in Table 4. The boys ranged in age from 7 years, 5 months to 10 years, 7 months with a mean age of 8 years, 8 months. They attended eight different schools in eight different school districts. Five children were in second grade, two were in fourth grade, and one was in fifth grade. One boy attended a self-contained Learning Disabilities class; the others were in regular class placements. All subjects were of normal intelligence with a mean IQ of 108.

Upon entering the study, all subjects had been taking prescribed stimulant medication for hyperactivity for at least eight months and up to 9 years, 2 months. During baseline, subjects continued on the same medication at the same dosage. Six continued to take methylphenidate (Ritalin) and two continued on pemoline (Cylert). Dosages of methylphenidate ranged from 10 to 45 mg per day with a mean dose of 30.83 mg per day. Daily amount of methylphenidate in milligrams per kilogram body weight ranged from .32 to 1.48 with a mean of 1.10 mg/kg body weight. One child took medication only in the morning, one took it in the morning and at noon, and four took medication morning, noon and after school.

Table 4

Subject Characteristics

Subject	Age in Years	Grade & Class Type	Medication	Daily Dosage	Mg/Kg Body Weight	Time on Medication	Percentile Weight for Age	Percentile Height for Age	IQ
1	10-2	4 Regular	Methylphenidate (Ritalin)	40 mg	1.44	9-2 yrs.	23	20	119
2	10-7	5 Regular	Methylphenidate (Ritalin)	30 mg	.77	4-2 yrs.	75	97	120
3	7-5	2 Regular	Methylphenidate (Ritalin)	25 mg	1.30	10 mo.	5	5	96
4	8-3	2 Regular	Methylphenidate (Ritalin)	10 mg	.32	1-3 yrs.	88	90	105
5	7-5	2 Regular	Methylphenidate (Ritalin)	35 mg	1.30	8 mo.	80	96	116
6	10-3	4 Learning Disability	Pemoline (Cylert)	56.25 mg	----	1-4 yrs.	78	97	109
7	8-0	2 Regular	Methylphenidate (Ritalin)	45 mg	1.48	1-3 yrs.	88	91	105
8	7-9	2 Regular	Pemoline (Cylert)	37.5 mg	----	9 mo.	87	90	92

The dosages of the two boys taking pemoline were 37.5 mg and 56.25 mg. Both boys took the drug in one dosage in the morning as is usual practice with this medication (cf. Physicians' Desk Reference, 1979).

The parents of the boys involved in this study were all middle class with a median Hollingshead SES rating of 2.5. Six (75%) were natural parents; two (25%) had adopted their sons. Three boys (38%) were from single parent families. Mothers ranged in age from 27 to 39 with a mean age of 32 years. Fathers were aged 31 to 52 with a mean age of 42 years. All parents considered their children to be hyperactive before the age of five. All had also sought out and tried a variety of special services to help their children including additive-free diets, family counseling, individual therapy for the child and special sports programs. Families had tried between three and four such services before entering this study.

Treatment

Self-Control Instruction for Children

A 48 lesson curriculum was developed to teach hyperactive children strategies for controlling their own behavior. The curriculum was comprised of four components: self-direction, motor inhibition, attending, and social problem-solving. Skills taught in each component are presented in Table 5. Four children received self-control instruction. They were taught four 45 minute lessons each

Table 5

Self-Control for Kids Curriculum

COMPONENT	LESSON	SKILL TAUGHT
Self Direction		
	1 - 4	How to think aloud
	5 - 8	How to evaluate your own work
	9	How to attribute progress to your own efforts
	10 - 11	How to prepare to do a task
	12	Review
Motor Inhibition		
	13	How to relax
	14 - 16	How to control anger
	17	How to control nervousness
	18	How to control touching
	19	How to wait
	20	How to keep from talking out
	21	How to discriminate fast and slow speeds
	22 - 23	How to adjust speed to tasks and situations
	24	Review
Attending		
	25	How to learn from models
	26	How to make eye contact
	27	How to control body talk
	28 - 29	How to check with someone to make sure you understand them
	30 - 31	How to get someone's attention
	32	How to know what someone is feeling
	33	How to express your feelings verbally
	34	How to communicate accurately to another
	35 - 36	How to resist distraction
	37	Review
Social Problem Solving		
	38	How to join an activity
	39	How to invite another to participate
	40	How to make someone feel good
	41	How to make friends
	42	How to recognize a problem
	43 - 44	How to come up with solutions
	45	How to recognize consequences
	46 - 47	How to choose good solutions
	48	Review

week for 12 weeks. Each child received a total of 36 hours of instruction.

Half of the lessons were taught in the child's own school during regular class hours. These sessions took place in the afternoon so as not to conflict with classroom observations or instruction in reading or math. Approximately 25 percent of the lessons required the participation of a second child. In these cases, the school principal selected a child of the same age but in a different class to participate in the lesson and serve as a positive model for the hyperactive child. All school sessions were conducted outside of the regular classroom in space provided by each principal.

The other half of the lessons were taught at the Center for Educational Research at Stanford (CERAS). Children came to the Center one night each week for 12 weeks and were taught two lessons each night with a 15 minute break in between. Parents of these four children attended child management classes at Stanford while their children were involved in self-control instruction.

Structure and Content of Lessons

Each lesson had the same basic format. First, the instructor reviewed the child's homework from the previous lesson. Next, a new skill was presented. The instructor described the skill, modeled it, and had the child practice it. A variety of techniques were used including board

games, videotapes, audiotapes, worksheets, roleplays, card sorts, and quiz games. The purpose of this practice was to familiarize the boy with the numerous ways he could use the skill and make it a routine part of his everyday behavior. Next, the child was given a new homework assignment that required him to try out the skill at school or at home in order to promote generalization. Finally, he was rewarded for his performance in the lesson.

Reinforcement System

A token system was implemented to reward the child for task-appropriate behaviors such as paying attention, sitting still, coming on time and returning homework as well as for practice of new skills. The system was used in all lessons. Each child could earn up to 50 tokens per lesson, 20 for task-appropriate behaviors and 30 for skill practice. Tokens were counted at the end of each lesson and exchanged periodically for prizes. Initially, children could receive a prize at the end of each lesson by reaching individually-determined criteria. The criteria were gradually increased, requiring children to perform appropriately for several days before earning a prize. By the twelveth week of instruction, children earned a prize about once a week. Prizes were small toys costing 39 cents

or less and of high interest to boys aged 7 to 10. Examples included baseball cards, toy cars, pocket games and school supplies. All prizes were provided by the project.

Instructors

The Self-Control Curriculum was taught by six different people. Two were the Co-Directors of the project; the other four were upperclass undergraduates at Stanford University. Each instructor taught each of the four boys on a rotating schedule.

To insure uniformity of presentation, two steps were taken. First, detailed lesson plans which specified exactly what the instructor was to do and say and how he or she was to respond to the child were developed. Lesson plans for the complete Self-Control Curriculum can be found in Appendix D. Second, all instructors participated in a comprehensive training program. This training consisted of two one and one half hour sessions per week for the 18 weeks of the study and was led by the Project Co-Directors. Sessions covered weekly curriculum content, behavior management techniques, how to use the reinforcement system, reading on the hyperactive child, and discussions of the management and progress of individual children. Modeling was used extensively throughout training, and feedback on teaching performance was constantly provided. Process notes were made by the instructor after he or she completed

teaching a lesson. These notes provided a systematic and ongoing record of what each subject had been taught and how he performed in the session.

Child Management Classes for Parents

An eight session, twenty hour behavior management program was developed to teach parents of hyperactive children how to better control their sons. Skills taught included how to pinpoint problem behaviors, how to increase positive behaviors and decrease hyperactive behaviors, how to use time out, how to develop parent-child contracts, how to use a point system, and generally, how to control a hyperactive child without the use of medication. An overview of the curriculum is presented in Table 6. The primary text for the course was Changing Children's Behavior (Krumboltz & Krumboltz, 1972). Supplemental readings were drawn from Families (Patterson, 1971), Helping Students Help Themselves (Goodwin & Coates, 1976), Counseling Methods (Krumboltz & Thoresen, 1976), and an article summarizing the newest research on hyperactivity by Kolata (1978).

Six sets of parents participated in these classes. For two couples this was the only intervention. The children of the other four couples simultaneously received self-control instruction. Classes met weekly for the first four weeks, and every other week for the next eight weeks. On weeks when classes were not held, parents were contacted by telephone to find out how the week went and to answer any

Table 6

Child Management Classes for Parents of Hyperactive Children

Session	Title	Topics Covered
1	Our Hyperactive Children	Discussion of schedules and refundable deposits Goals of parent classes Characteristics of our children - film: "Like Any Child Only More So" Myths about hyperactivity Drugs and hyperactivity - current research
2	Increasing Appropriate Behavior	The principle of reinforcement Types of reinforcement How to choose reinforcers for your child - A menu to select from Schedules of reinforcement - How to fade it out The principle of successive approximations - How to shape behavior How to reinforce inappropriate behavior How to develop action plan to increase pinpointed behavior
3	Decreasing Inappropriate Behavior I	Satiation Extinction - How to ignore, when to ignore The principle of intermittent reinforcement How to reinforce incompatible behaviors Roleplay demonstrating how to ignore
4	Decreasing Inappropriate Behavior II	Punishment - Pros and cons Time-Out - How, when and where to use it Demonstration in the use of time out How to develop and action plan to decrease pinpointed behavior
5	Modeling, Cueing and Contracting	The principle of observational learning - why it's important to model for hyperactive children Cuing - what it is Types of cues we give How to use cues with hyperactive children What is a parent-child contract How to develop a simple contract to increase or decrease a behavior
6	Contracts and Point Systems	General principles of contracts How to use a point system to change many behaviors at once How to design a point system for your child to increase and decrease his behaviors
7	Troubleshooting	Why analyze behavior What are antecedents What are consequences How to use ABC charting to change behavior Troubleshooting together at home
8	Maintenance of Change	The pros and cons of living with a non-medicated child Adjusting to your child off medication Tips on taking care of yourselves How to find the best teacher for your boy How to maintain the progress you've made

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questions. All classes were held at the Center for Educational Research at Stanford (CERAS) and were taught by one or the other of the Project Co-Directors. To insure consistency of presentation, detailed lesson plans specifying points to be made and examples to be used were developed. In an effort to guarantee that parent training conformed to prepared lesson plans, the Project Co-Director met after each lesson to review what had been taught the parents. The Child Management Class Curriculum can be found in Appendix E.

Two couples participated in each parent group. Sessions lasted approximately two and one half hours and followed the same general format each week. First, the previous week's homework assignment was discussed in detail. Any problems parents had in implementing newly learned behavior management principles were resolved before new material was presented. Next, the previous week's take home quiz was reviewed, and questions about assigned readings were answered. Third, new material was presented and its application to individual children discussed. Roleplays were often used to demonstrate to parents more effective ways of managing their sons. Lastly, new homework was assigned which required the practice of skills just presented. Parents chose which of their child's problem behaviors to apply the skills to. The most common behaviors chosen by parents are presented in Table 7. Care was taken

Table 7

Behaviors That Parents of Hyperactive Boys Chose to Change

- Not going to bed on first request
- Not getting to school on time
- Interrupting parent conversations
- Making strange or disruptive noises
- Arguing and talking back when asked to do something
- Wetting the bed at night
- Hitting parent, sibling, or other child
- Not coming when called
- Destroying property
- Not completing homework on own
- Chasing the dog in the house
- Jumping on furniture
- Putting things back where they belong

throughout the program to tailor assignments and examples to the specific needs of parents of hyperactive children.

The four sets of parents whose children received self-control instruction were given an extra assignment each week. They were asked to practice with their children one or two specific skills the boys had learned in self-control training. The purpose of this practice was to familiarize parents with what their children had learned and to teach them to reinforce the boys for using self-control skills at home. Discussion of these additional assignments took approximately five minutes of class time each week.

There was no fee for parent classes or self-control instruction. However, in order to insure that both parents attended all parent classes, eight refundable checks were collected at the first meeting. The amount of these checks varied from ten dollars to thirty-five dollars per week, depending on family income. Parents were asked to determine the amount of each check on the basis of a local mental health agency's sliding fee scale. The only requirement was that each check be large enough to motivate them. Weekly checks were refunded only if both parents attended the class, completed the reading assignment, and followed through with behavior change projects. All fathers as well as mothers attended every parent class. All couples received eight refund checks.

Teacher Consultation

Teachers of the six children who received either treatment were consulted periodically by the Project Co-Directors to find out how the children were progressing in school and to answer any questions. The amount of contact varied depending on how frequently teachers felt the need to talk to someone on the project. The number of consultations ranged from a high of once per month to a low of once over the course of the study. Requests for consultations were more frequent in the last month of treatment coinciding with the time when the children were on the lowest dosages of medication.

Teachers received consultation on how to reinforce the child's use of self-control skills at school. In addition, teachers who requested it were given help in setting up simple classroom incentive programs and time out procedures.

Medication Withdrawal

The six children who received treatment were gradually withdrawn from stimulant medication simultaneous to intervention. During baseline and through the first week of treatment, all children remained on their usual dosages of medication. Beginning with the second week of parent classes and continuing each week thereafter, dosages were reduced. Reductions were generally small, ranging from 2.5 mg to 7.5 mg per week for boys taking methylphenidate and 9.375 mg per week for boys taking pemoline. To facilitate medication withdrawal, each child's pediatrician was asked

to prescribe the child's regular medication in the smallest tablets possible (5 mg tablets of methylphenidate and 18.75 mg tablets of pemoline). (See Appendix C). Parents were responsible for seeing that the child received the appropriate daily dosage of medication at home and at school. They knew precisely how much medication their child was taking each day. Teachers and the children themselves knew that dosages were reduced but did not know exactly how much they were reduced by. Classroom observers were totally uninformed about the nature of the study and were not told that any children they were observing were taking stimulant medication.

To insure that all children would be withdrawn from medication by the end of the study, an individual reduction schedule was drawn up for each child. Each week at child management classes parents were informed of the amount of medication their children would be taking for the following week and were told to begin this lower dosage the next day. Reduction schedules were generally adhered to. However, if classroom observations for two consecutive weeks showed deterioration in the hyperactive child's behavior, the dosage remained at the same level for an additional week to allow behavior to stabilize. Reductions were continued following this stabilization period.

Five out of the six treated children were withdrawn from medication according to schedule. The number of weeks

it took to reduce medication for each child is presented in Table 8. Overall, it took an average of 8.4 weeks to accomplish this reduction. The five boys who completed drug withdrawal were off medication entirely for an average of 3.6 weeks by the end of the study. The sixth boy was never withdrawn completely from medication. His parents refused to reduce his dosage below 33% of his original amount because they felt his behavior had deteriorated significantly. Classroom observations did not substantiate their conclusions. However, this conflicting evidence had no influence on the parents. Rather than lose this family from the sample, Project Co-Directors decided to follow the child's progress to the end of the study.

Design

An intensive (time-series) design was used to assess the effects of the two non-drug interventions on the behavior of hyperactive children relative to drug therapy (cf. Glass, Willson & Gottman, 1975; Hersen & Barlow, 1976; Kratochwill, 1978). Four children received the combined treatment, Self-Control Instruction plus Child Management Classes for Parents. The parents of two additional children attended Child Management Classes only; their sons did not receive special instruction. Each of the children who received treatment were simultaneously withdrawn from medication. Another two children served as delayed treatment controls. They participated in all assessment procedures but remained on their usual dosages of

Table 8

Weeks to Reduce Medication to Various Levels

Subjects	Original Dosage	Weeks to 50% Medication	Weeks to 25% Medication	Weeks to 0% Medication	Weeks Off Medication
1	40 mg Ritalin	4	10	11	1
2	30 mg Ritalin	6	--	--	--
3	25 mg Ritalin	6	8	9	3
4	10 mg Ritalin	4	5	5	7
5	35 mg Ritalin	4	7	10	2
6	56.25 mg Cylert	3	4	7	5
$\bar{x}$		4.5	6.8	8.4	3.6

medication and did not receive the behavioral treatment until the study was completed. All eight subjects were observed over an 18 week period, three to four weeks of baseline, twelve weeks of treatment and two weeks directly following treatment. Figure 3 presents an overview of the research design.

Experimental control was enhanced by several design features: time-lagged treatments, delayed treatment controls, within subject comparisons, and random assignment to treatment.

The first control, time-lagged treatments, involved providing the same treatment to more than one subject, but beginning intervention one week later for half the subjects in each treatment. This time-lag feature serves two purposes. First, it may provide replication effects; that is, the delayed subjects may show the same changes in behavior with treatment as their yoked partners. Second, it can demonstrate the functional relationship between treatment and outcome if the lagged subjects show treatment effects a week later than their partners.

In keeping with the time-lag feature, Subjects 3 and 4 in the combined treatment received their first instruction one week later than Subjects 1 and 2. Ideally, Subject 6 in the Child Management Classes only treatment should have received instruction one week later than Subject 5. However, this would have meant that parents in this

Figure 3

Research Design

Weeks

Ss	1 2 3	4 5 6 7 8 9 10 11 12 13 14 15	16 17 18
1	Baseline	Self-Control Instruction for Children & Child Management Classes for Parents	Post Treatment Observations
2	Baseline	Self-Control Instruction for Children & Child Management Classes for Parents	Post Treatment Observations
3	Baseline	Self-Control Instruction for Children & Child Management Classes for Parents	Post Treatment Observations
4	Baseline	Self-Control Instruction for Children & Child Management Classes for Parents	Post Treatment Observations
5	Baseline	Child Management Classes for Parents Only	Post Treatment Observations
6	Baseline	Child Management Classes for Parents Only	Post Treatment Observations
7	Baseline	Delayed Treatment Control	Post Treatment Observations
8	Baseline	Delayed Treatment Control	Post Treatment Observations

treatment received individual instruction rather than small group instruction. Such individual attention would have been different from that received by parents in the combined treatment. Since one of the purposes of this study was to compare the effects of self-control instruction combined with child management classes to child management classes alone, it was essential that parent instruction was identical in the two treatments. Consequently, Subject 6 was not lagged behind Subject 5. Both began treatment in week 5.

To further increase experimental control, two delayed treatment subjects were included in this design (Subjects 7 and 8). These subjects were observed and tested over the entire course of the study but did not receive any form of treatment until the conclusion of the research. They continued on their usual dosages of medication for the 18 week period. These two subjects were included to control for possible threats to internal validity such as the nonspecific effects of intensive measurement, attention, and expectancy.

A third feature of the design which controlled for variability among hyperactive children was the use of each subject as his own control. Hyperactive children as a group are extremely heterogeneous; they differ in their behavioral characteristics, their response to stimulant medication, and their reactions to behavioral interventions

(O'Leary & Pelham, 1978; Ross & Ross, 1976; Barkley, 1977). In light of this variability, the most clinically relevant measure of treatment effects is within the same child rather than between groups of children. In this intensive design, the effects of several different treatments were observed in the same child: full medication, partial medication plus treatment and no medication. In this way, questions about the relative efficacy of behavioral interventions versus stimulant medication for the same child could be addressed.

To further enhance experimental control, all subjects were randomly assigned to treatment. This design feature insured that there was no bias in determining which subject received which treatment.

Dependent Measures

Time Series Analyses

Classroom Observations

If interobserver reliability is high, classroom observations are the most objective way of assessing the behavior of hyperactive children in school (Sulzacher, 1973). Further, research has consistently demonstrated that behavioral observations can discriminate hyperactive children on and off medication as well as before and after treatment (Abikoff et al., 1977; Whalen et al., 1978; O'Leary & Pelham, 1978). Since the purpose of this study was to assess objectively the effects of two behavioral

treatments compared to stimulant medication, an observation system was considered essential. Such a system needed to meet three criteria. First, it had to have face validity for hyperactive children; that is, it needed to measure a variety of behaviors that hyperactive boys were known to display. Second, the behaviors assessed needed to be well defined and easily observable so that a high level of interobserver reliability could be attained in all behavioral categories. Last, the observation system needed to measure the behavior of both the hyperactive child and others in the environment as the behavior of others may contribute to the maintenance of hyperactive behavior.

None of the currently available classroom observation systems met all three of these criteria (Abikoff et al., 1977; Whalen et al., 1978; Williams et al., Note 1; O'Leary & Pelham, 1978; Campbell et al., 1977). Consequently, a new system was developed based on the strengths of current systems and in keeping with the requirements of this study.

The Hyperactive Behavior Observation System (HBOS)

The Hyperactive Behavior Observation System (HBOS) (Kirmil-Gray & Duckham-Shoor, Note 4) is comprised of eleven behavioral categories, nine which assess the behavior of the target child and two which assess the behavior of others in the environment. Specific behaviors coded and their definitions are presented in Table 9. The HBOS Scoring

Table 9

Hyperactive Behavior Observation System (HBOS)

Code Definitions

On/Off Task	
●On Task (OnTask)	Doing what is expected as specified by teacher, curriculum or classroom rules. Score On Task if unsure whether the child is on or off.
●Off Task (OffTask)	Not doing what is expected as specified by teacher, curriculum, or classroom rules for any period of time during the observation frame. Score as Off Task even if child looks away from his work or the teacher only briefly.
In/Out Seat	
●In Seat (Inseat)	Sitting on a chair or, when appropriate, on the floor with at least one buttock touching surface. Code In Seat unless certain child is out of seat.
●Out of Seat (OutSeat)	Sitting or standing with both buttocks out of chair, even if child returns to in-seat by end of observation frame.
Fidget (Fidget)	Moving body while in relatively stationary position in or out of chair; most often repetitive movements.
Locomotor (Loco)	Moving at least one step or one foot away.
Touch (Touch)	Contacting another person or his property with body or object. Target child must be an active participant. Continue to score Touch during consecutive observation frames if child keeps touching.
Non Comply (NonCom)	Not taking an action that is requested by the teacher within one time frame; request can be directed at either the group or the individual child. Always score Off Task as well.
Verbal (Verbal)	Any verbal response by the child; code Verbal if child's lips are moving or his voice is recognizable and it is clear that words are being spoken even if content of message is not clear.
● Positive Verbal (PosVerb)	A verbal response which actively initiates social contact or is made in response to another's attempt to make contact.
● Negative Verbal (NegVerb)	A verbal response which is argumentative, disapproving or commanding.
Talkout (Talkout)	A spontaneous verbal response which is inappropriate for time, place, and activity; has impulsive quality; most often loud and attention-getting.
Noise (Noise)	An audible sound made by child with or without the use of mouth.
Teacher Attention (TAttn)	Physical or verbal attention directed at the child being observed. Only code Teacher Attention if she speaks to the child, touches the child, smiles or looks at the child and he looks back.
● Positive Teacher Attention (TPos)	Positive physical or verbal attention directed at the child being observed.
● Negative Teacher Attention (TNeg)	Negative physical or verbal attention directed at the child being observed.
Peer Attention (PeerAttn)	Physical or verbal attention directed at the child being observed. Only code Peer Attention if peers speak to, touch, smile or look at child and he looks back.
● Positive Peer Attention (PeerPos)	Positive physical or verbal attention directed at the child being observed.
● Negative Peer Attention (PeerNeg)	Negative physical or verbal attention directed at the child being observed.

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Manual can be found in Appendix F.

Observational Procedures

Observations were conducted three days per week for eighteen weeks on each of the eight boys in the study. No observations were conducted on Fridays as activities on this day tend not to be representative of the rest of the week. Of the four other school days, three were randomly selected each week as observation days. On each of these days, observers spent 30 minutes coding classroom behavior during math or reading periods--15 minutes on the hyperactive child and 15 minutes on comparison children. The reason for observing comparison children was to provide a control for general activity level and to establish a classroom standard against which to evaluate the behavior of the hyperactive child. All boys in each hyperactive child's class served as comparison children on a rotating basis.

The observation period was broken down into six 5-minute blocks. Observers made the first 5-minute observation on the hyperactive child, the second on a comparison child, the third on the hyperactive child again, the fourth on a different comparison child, the fifth on the hyperactive child, and the last on a third comparison child. Observations were alternated in this way to control for changes in classroom activity and to insure that hyperactive children were observed engaging in similar tasks as comparison children.

Each 5-minute observation block was further divided into 45 20-second frames. In each of these frames, observers spent the first ten seconds observing the behavior of either the hyperactive child or a comparison child and the next ten seconds coding the specific behaviors observed. Two behaviors, On/Off Task and In/Out Seat were coded every frame. The remaining nine categories were coded only if they occurred. Standardized cassette audiotapes and earphones were used to cue observers about when to observe, when to code, and when to switch to a new child. Behaviors were recorded on prepared codesheets which required that observers place a slash mark in the appropriate boxes. A sample codesheet is presented in Table 10.

Observers

Observers were recruited from the community through newspaper ads and posters placed in local school district offices. These announcements advertised the project as a developmental study of the natural abilities of elementary school children to control themselves in the classroom. Twenty-one people applied for the position. From this group, ten were selected for training, eight women and two men. Eight of the ten people completed training and served as paid observers during the study. None of the eight were members of the Stanford University community, and all were available Monday through Thursday mornings to observe in schools throughout the two county area. Two people, one

Table 10

Sample Codesheet

SELF-CONTROL FOR KIDS PROJECT
Daily Observation

Child _____ Observer _____ Activity _____ Time Begin _____

Teacher _____ Date _____ ☐ individ. ☐ class ☐ sm. grp. Time End _____

	Task	Seat			Fidget	Loco-motor	Touch	Non Comply	Verbal	+	-	Talk Out	Noise	T Attn	P Attn	+	-
	On	Off	In	Out													
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	

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woman and one man, completed training but were not hired as observers because they failed to master the coding system.

Observers were told that in order to maintain their objectivity, there would be aspects of the study about which they would not be informed. They were asked to report any additional infomation they learned about the project to one of the Project Co-Directors. Observers were kept blind regarding the fact that the study involved hyperactive children, medication, and treatment. Further, they were kept unaware that one child in each classroom was the target of study and that other children were observed only for comparison purposes. To reduce the possibility of information leaks, weekly staff meetings were held away from the project office. Follow-up interviews conducted by a research assistant uninvolved in observer training and supervision showed that these procedures were generally effective in maintaining observer blindness. No observer knew which children were being treated nor which were withdrawn from medication.

Observer Training

All observers participated in a 30 hour training program over a five week period of time. Training consisted of discussion and clarification of each observation category, viewing and coding of videotapes of hyperactive and non-hyperactive boys in their classes, and in-vivo coding of children not involved in the study. In addition,

observers were instructed about how to remain unobtrusive in the classroom and professional in the school. Throughout training, interobserver reliability checks were made. Observers continued training until a criterion of .85 interobserver agreement on the overall code was reached by each observer.

Following training, observers began making formal observations. A schedule was developed to insure that each observer coded the behavior of each hyperactive child approximately the same number of times. During the first weeks of the study, eight observers collected data. For a variety of reasons, three observers dropped out over the course of the study: one because of a family crisis, one because of transportation problems, and one because she felt compensation was insufficient. At the conclusion of the project, five observers were making all observations.

Interobserver Reliability

To insure that all observers coded behaviors in the same way, staff meetings were held each week. At these meetings code definitions were discussed and procedural questions raised. A list of code clarifications was prepared following each meeting and distributed to all observers.

In addition, interobserver reliability was formally assessed throughout the study. One observer was designated as the reliability checker. This person always accompanied

a second observer into the classroom. The pair coded the behavior of the same children at the same time. Their observations were synchronized by means of a jack that allowed two sets of earphones to connect to the same cassette tape recorder.

Reliability checks were made on 8.52 percent (N=30) of the observations (N=352). The reliability of each observer was checked on an average of once every 2.85 weeks.

Interobserver reliability was calculated using the per cent agreement formula:

Agreements/Agreements + Disagreements X 100

This calculation was made for each individual code as well as for the observation system as a whole. Average reliability for individual codes ranged from 81.7 percent to 99.9 percent. Overall reliability calculated across all observers and all codes was 95.2 percent. Interobserver agreement coefficients are reported in Table 11.

The percent agreement method of calculating reliability has both advantages and disadvantages. The major advantage is that it is simple and easily interpretted. The major disadvantage is that this statistic is heavily dependent on the specific rate of behavior for the session in which it is calculated and may overestimate observer agreement when the frequency of behavior is very high or very low (Hartman,

Table 11

Hyperactive Behavior Observation System (HBOS)
Reliability Coefficients

Overall System	95.2
On/Off Task	85.6
In/Out Seat	97.9
Fidget	81.7
Locomotor	88.4
Touch	99.0
Non-Comply	99.8
Verbal	87.9
Positive	99.9
Negative	99.2
Talk Out	98.7
Noise	94.6
Teacher Attention	91.3
Positive	99.6
Negative	99.3
Peer Attention	95.7
Positive	99.7
Negative	99.3

1977; Kratochwill & Wetzel, 1977). This statistic was chosen as most appropriate for this study for several reasons. First, different codes in this observation system had different base rates, and base rates varied from session to session. Special agreement statistics may have provided more conservative estimates of interobserver agreement, but their use would have been very complex and inconsistent across codes and across sessions. The meaning of reliability coefficients under these conditions would have been questionable. The total agreement method of calculating reliability has been recommended over more sophisticated methods in situations where observers record multiple responses using paper and pencil scoring (Repp, Dietz, Boles, Dietz, & Repp, 1976). Second, the base rates of individual codes were expected to change over time as subjects were withdrawn from medication and treated. However, there are no guidelines for when to use special agreement statistics when differential rates of behavior occur during an experiment (Kratochwill & Wetzel, 1977). Finally, most observational studies of hyperactive children have reported percent agreement reliability. Use of the statistic in this study allows direct comparisons between this observation system and those used by other researchers.

School Notes

To supplement classroom observation data and to measure how teachers perceived hyperactive children in class, School

Notes were developed for each of the hyperactive boys in the study. Notes were comprised of the four or five school behaviors that each child had trouble demonstrating on a consistent basis. Two of these were academic behaviors and two were social behaviors. Items were selected by each child's teacher from a comprehensive list provided by the Project Co-Directors (Appendix B). Each item was rated daily on a scale from one to five. A score of one indicated that the behavior did not occur at all; a five indicated that it occurred all the time. Each teacher completed these ratings at the end of each school day and gave the note to the hyperactive child to take home to his parents. Parents returned completed School Notes to project staff on a weekly basis. A sample of a completed School Note is presented in Table 12. School Notes for all eight boys can be found in Appendix G.

Research assistants totalled each child's daily ratings on a weekly basis. To standardize scores, ratings were converted to a 25 point system. Total scores ranged from 5 to 25. The higher the score, the better the child's school behavior.

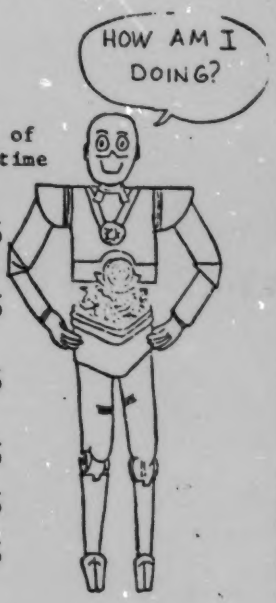
Home Behavior Reports

To assess the behavior of hyperactive children at home, the frequency of ten problem behaviors were recorded on a daily basis during the placebo trials of this study. These behaviors were selected by each child's parents from a

Table 12

Completed School Note

HOW STEVE DID AT SCHOOL TODAY:



	Not at all	Very little	Moder-ately	Most of the time	All of the time
WORKED WITHOUT DISTURBING OTHERS	1	2	3	(4)	5
STAYED IN SEAT DURING CLASS PERIOD	1	2	3	(4)	5
LISTENED TO AND FOLLOWED TEACHER'S DIRECTIONS	1	2	3	(4)	5
COMPLIED WITH FIRST REQUEST	1	2	(3)	4	5
FINISHED HIS WORK IN CLASS	1	2	3	(4)	5
OTHER _____	1	2	3	4	5

SIGNED M. Curran (TEACHER) DATE 3-6

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comprehensive list provided by the Project Co-Directors (Appendix B). In this way, Home Behavior Reports were tailored to the problems of the individual child. At the end of each day, parents circled the number of times each problem behavior occurred on a scale from zero to four. They also recorded the number of hours each of them spent with the child that day. A sample of a completed Home Behavior Report is presented in Table 13. Home Behavior Reports for all eight subjects can be found in Appendix G.

Parents returned completed forms to project staff each week. Research assistants calculated the total frequency of the ten problem behaviors for each day. Scores ranged from 0 to 40, with lower scores indicating fewer problems and therefore, better behavior. To correct for variability in total problem behaviors due to the varying number of hours spent with the child, a further calculation was made. The total number of problem behaviors was divided by the highest number of hours spent with the child by either parent on a given day. This calculation yielded the number of negative behaviors per hour displayed by the child at home.

Pre-Post Measures

In addition to daily data, a battery of pre-post measures was administered to each hyperactive child to gather additional information on the effects of treatment. All eight boys were brought by their parents to the Center for Educational Research at Stanford for testing on two

Table 13

Completed Home Behavior Report

Center for Educational Research at Stanford

Self-Control for Kids Project
Parent Checklist

How many times did David do these behaviors today? Circle the appropriate number.

1.	Hit sibling (slap, kick, pinch)	0	1	(2)	3	4 or more
2.	Hit parent	(0)	1	2	3	4 or more
3.	Argued or talked back to parent	0	(1)	2	3	4 or more
4.	Failed to comply with first requests	0	1	2	3	(4) or more
5.	Used abusive language, gestures or swore	0	1	(2)	3	4 or more
6.	Got up and down while eating	0	1	(2)	3	4 or more
7.	Touched or destroyed other people's things	(0)	1	2	3	4 or more
8.	Played with dangerous things	(0)	1	2	3	4 or more
9.	Failed to control himself when angry	0	1	(2)	3	4 or more
10.	Threw objects across the room or at people	0	1	2	(3)	4 or more

Additional Comments:
WANTED TO CLIMB OUT THE WINDOW (HIS BED ROOM WINDOW) BEFORE BREAKFAST.

JOANNE LEFT FOR L.A. THIS MORNING FOR THREE DAYS.

Approximately how many hours did each of you spend with David today?

1½ Joanne 7½ Ed

Completed by ☐ Joanne ☒ Ed ☐ Other _____

Date Feb 1
Mon

SCHOOL OF EDUCATION STANFORD UNIVERSITY STANFORD, CALIFORNIA 94305 (415) 497-4717

Saturdays, one during baseline and one at the end of treatment. Both times, parents had been instructed to withhold their child's medication. Boys on methylphenidate did not receive medication after 3 PM the Friday before. Boys on pemoline did not receive medication after 8 AM the Thursday before. On each testing occasion, boys participated in seven different activities over a two and one half hour block of time. Some measures assessed academic progress, others social interaction. Project Co-Directors and research assistants served as examiners on both occasions.

In total, the results of six different pre and posttest measures are reported, yielding twelve gain (difference) scores for each child in the study. Tests were selected on the basis of how well they satisfied the following criteria:

1. consistency with measures used in previous research so as to allow comparison of current findings with past results.

2. sensitivity to differences between normal and non-treated hyperactive children.

3. sensitivity to the presence of stimulant medication in the hyperactive child.

4. ability to assess some aspect of cognitive, intellectual, or academic performance.

Wide Range Achievement Test (WRAT)

Reading. Level 1 of the reading subtest of the WRAT was used to measure the child's ability to recognize and name letters and to pronounce words. The test was administered according to instructions outlined in the 1965 revised edition of the Manual of Instructions.

A total raw score of 100 was possible on the reading subtest: 25 points for letter naming and recognition, and 75 points for word pronunciation. Subjects under eight years of age were administered both parts of the test. Children eight years and older began the test at the word pronunciation part. If they correctly read the first line of words in this part, they were assumed to have been able to successfully complete the previous letter naming section and were automatically awarded the 25 points. For every word pronounced correctly within the ten second limit, an additional point was earned.

Testing was continued until twelve consecutive pronunciation failures were recorded. Raw points were totalled and converted to grade norms following the schedule provided on the test blank. Achieved grade equivalent was compared to actual grade equivalent to produce a standard score for the subject. Standard scores are normally distributed with a mean of 100 and a standard deviation of 15. Data analysis procedures were performed on the difference scores obtained by subtracting the pretest

standard score from the posttest standard score.

Math. Level 1 of the arithmetic subtest of the WRAT was used to measure each child's ability to count, read number symbols, solve oral problems and perform written computations. The test was administered according to the 1965 revised instructions.

A total raw score of 63 was possible on the arithmetic subtest: 20 points for the oral part and 43 points for the written part. All subjects began the test with the written part. Those children who were less than eight years of age and those who scored less than five points on the written part were administered the oral part, also. If the child scored more than five points on the written part, he was assumed to have been able to successfully complete the oral part and was automatically awarded the 20 points. He earned an additional point for each written problem he completed within the ten minute time limit. Raw points were totalled and converted to grade norms following the schedule provided on the test blank. Standard scores were calculated and from them pre to posttest gain scores were computed. Gain scores were then subjected to data analysis.

Wechsler Intelligence Scale for Children (WISC)

Coding subtest. The coding subtest of the WISC was used to measure the child's ability to sustain attention during a repetitive task. This particular subtest was chosen because it is one of the few intelligence measures

which has demonstrated the effectiveness of drug treatment for hyperactive children on any consistent basis. The coding subtest was administered according to instructions provided in the 1949 tester's manual. Subjects under eight years of age were given coding test A and subjects eight years and older were given test B.

Subjects were given two minutes to copy the markings on a standard set of stimuli to a set of blank stimuli. The child scored one point for each blank he filled in correctly. The maximum score for test A was 50 and for test B the maximum was 93. Pre and posttest gain scores were calculated and then subjected to data analysis.

Matching Familiar Figures Test (MFFT)

The MFFT was used to measure relection-impulsivity. It consisted of 14 sets of pictures of familiar objects and animals, two practice and 12 test items. The child was shown a standard stimulus and simultaneously six similar ones and was required to choose the one picture from among the six alternatives which was identical to the standard. If the child made an incorrect choice, he was told he made an error and that he should look again. All responses were recorded until he made a maximum of six errors or got the item correct. Two variables resulted from this test. The total number of errors was recorded up to a maximum of 72. In addition, the time it took the child to make his first response was recorded to the nearest half second. This

measure was taken for each of the 12 items and a mean latency to first response was then calculated.

A child is considered to have become less impulsive if between pre and posttesting, he shows a decrease in total errors, an increase in mean latency, or both.

Porteus Maze Test

The Vineland revision of the Porteus Maze test was used to measure ability to sustain attention and to plan and control visual-motor responses. It consisted of ten progressively more difficult mazes, beginning with a maze appropriate for a five year old and concluding with an adult maze. The subject was instructed to draw a line from the start of the maze to the finish without crossing any lines, or going into any blocked spaces. He was told that the test was not timed and that he could stop anywhere along the maze to decide where to go as long as he did not lift his pencil. If the child entered a blocked space, he was told he made an error and given a duplicate maze to begin again. The child continued on a maze until he erred a predetermined number of times or until he successfully completed it. All testing was stopped when the child failed any three mazes.

Two variables resulted from this test. The child's performance was scored both quantitatively and qualitatively using the Vineland procedures (Porteus, 1965). To obtain the quantitative score (TQ score), the highest maze passed in the allowable number of trials was used as a ceiling and

from it, one-half year was deducted for every previously unsuccessful trial. This resulted a test age from 5 to 17 years. The test age was then compared to the child's chronological age using the tables provided in the procedures. The TQ score resulted from this comparison. The TQ score is considered similar to an Intelligence Quotient.

To obtain the qualitative score (Q score), each maze was examined for quality of execution. Points were accumulated for a variety of performance errors, including crossed line, lifted pencil, cut corner, changed direction and blind alley entrance. There was no maximum number of negative points that could be accumulated, but the higher the Q score, the worse the performance.

A child was considered to have become more planful and better able to sustain concentration if his TQ score increased and/or his Q score decreased between pre and posttesting.

The Coopersmith Self-Esteem Inventory (SEI)

This test was used to measure the child's feelings of self worth. It consisted of 58 positive and negative statements about oneself that the child was asked to answer as either "like me" or "not like me." The higher the score on the SEI, the more likely the child is said to regard himself. Forms and answer sheets used can be found in Appendix H.

The inventory items sort into five subscales: home, school, social, general self and lie scale. Items having to do with the child's relationship with his parents are part of the home subscale. Items pertaining to the child's performance in class and on academic tasks are part of the school subscale. This dissertation will report the results of changes in the home and school subscales as well as changes in the total self-esteem score.

The Coopersmith Self-Esteem Inventory was selected as a dependent measure in this study because there is evidence that hyperactive children have lower self-esteem than comparison children (Campbell et al., 1977). Whether drug or behavior therapies could have any effect on self-esteem was a question of considerable interest. Since previous research with hyperactive children utilized the SEI, this scale was chosen for this study. Its test-retest reliability is reported to range from .88 over five weeks to .70 over three years (Coopersmith, 1967).

Physical Growth

Growth over the 17 week period of the study was measured in terms of gains in height and weight. Body weight was measured at pretesting and at posttesting using a 350 lb capacity fulcrum scale. Height was measured at the same time using a height calibrator (Detecto-Medic). Measures were rounded to the nearest quarter inch or quarter pound. Each subject's height and weight was compared to

that for all boys his same age using data from the National Center for Health Statistics (Hamill, Drizd, Johnson, Reed, Roche, & Moore, 1979). Comparisons resulted in percentile height and percentile weight for each of the eight boys. Percentile changes between pre and posttesting indicated greater-than-expected gains or losses in growth.

Data Analysis

Data for each of the eight subjects were first graphed and examined visually to detect the effects of treatment over time. Visual inspection was an informative method of analysis in some cases. However, in other cases, trends in the data were ambiguous to the naked eye. Therefore, visual inspection was employed as the primary method of data analysis only when it was clear that there were no differences between baseline and treatment phases. Data which appeared to change even slightly from baseline to treatment were analyzed using inferential statistical procedures.

Standard parametric statistics such as analysis of variance and regression procedures are inadequate for the analysis of time-series data for two reasons. First, parametric statistics are based on the assumption of independence of errors. This is not typically the case for data collected on the same individual over time. Rather, successive data points and their associated errors are often correlated with one another. Analyzing time-series data

using parametric statistics violates the assumption of independence of errors and can result in inflated Type I error and inaccurate conclusions regarding the effects of treatment (Glass, Willson, & Gottman, 1975; Scheffe, 1959; Kratochwill, 1978).

Second, parametric statistics do not have the capability of assessing patterns of change over time. Time-series data can change in a number of ways as a result of intervention. The level of the series may increase or decrease, the slope may reverse direction or become flatter or steeper, or both level and slope may change. Failure to assess both level and slope changes can result in faulty conclusions regarding the effects of treatment. For example, if behavior during baseline is improving and this trend continues during treatment, one might conclude using standard parametric statistics that treatment had a significant effect. The mean of the intervention phase would be higher than the mean of the baseline phase. In fact, treatment probably had no effect in this case as the slope of the series did not change. Parametric statistics also often fail to detect changes between baseline and treatment that are significant.

The limitations of standard parametric statistics for time-series data make other methods of analysis necessary. Data in this study were analyzed using Autoregressive Integrated Moving Average (ARIMA) procedures (Glass et al.,

1975).

Autoregressive Integrated Moving Average Procedures

The Autoregressive Integrated Moving Average procedure is a statistical method designed to assess patterns of change in time-series data. Data analysis consists of two steps. First, the underlying model of the series is identified. Next, this model is used to transform data so that dependency between data points is removed. The transformed data is then subjected to standard t-tests to determine whether changes in the level and slope of the series are significant. ARIMA procedures will be briefly described here. The reader can supplement this description by referring to Glass et al. (1973) and Gottman and Glass (1978).

Identifying the Model

Identifying the model involves determining the extent to which three possible sources of dependency between data points influence a time-series. First, the series may be stationary or non stationary; that is, it may fluctuate around a constant level or may drift upward or downward. This property is represented by the parameter *d*. Second, the series may be influenced by an autoregressive process in which an observation at a given time is predictable from the true score at previous observations. This property is denoted as *p*. Third, the series can be influenced by a moving averages process in which an observation at one point

in time is dependent upon previous random error in the series. This property is denoted as q.

The parameters p, d, and q are estimated by examining the correlograms of the lagged autocorrelation coefficients for baseline and treatment phases. Because an intervention can inflate correlations spuriously, correlograms are computed separately for data in baseline and treatment phases, and models are identified for each. In series where the models of each phase differ, correlations are averaged to yield the correlogram used in estimating the series parameters.

The first parameter, d, represents the degree of differencing required to produce a stationary series. If the lagged autocorrelations drop to zero after a few lags, the series is considered stationary, and d is assigned a value of zero. If the lagged autocorrelations fail to drop to zero fairly quickly, the series is characterized by deterministic drift. This source of dependency is removed by differencing the data. In this case d is assigned a value greater than zero depending on the degree of differencing required to produce stationarity. Once d has been identified, p and q can be estimated. The lagged autocorrelations in an autoregressive process (p) drop to zero exponentially (e.g. .53, .26, .05) while the lagged autocorrelations in a moving average process (q) drop to zero abruptly (e.g. .53, .03, .00).

It should be pointed out that model identification is an ambiguous process. Lagged autocorrelations rarely display the clear patterns described here. In this research, when the model could not be readily identified, several different models were tested. The model which yielded the lowest error variance (or best fit) was chosen as appropriate.

Assessing the Effects of Intervention

Once a model has been identified, intervention effects can be tested. The raw or differenced data are first transformed mathematically to remove the identified sources of dependency between data points. A least squares solution is then applied to the transformed data. This solution yields estimates of level, level change, drift, drift change, and the probability that level and drift changes occurred by chance. The probability value associated with the solution which results in the smallest error variance is used to determine the effects of intervention.

Summary

Eight hyperactive boys were selected for this study using a comprehensive screening procedure which insured that the stimulant medication they had been taking had a positive effect on their behavior. The boys ranged in age from seven to ten years old and had a mean IQ of 108. Six of the boys took methylphenidate (Ritalin) to control their hyperactivity; two took pemoline (Cylert). All had been

taking medication for at least eight months and up to nine years.

Subjects were randomly assigned to treatment. Four boys received a combined treatment. They received 36 hours of special instruction in self-control of hyperactive behavior while their parents attended an eight session, twenty hour course on the management of hyperactive children. The parents of two other boys were assigned to child management classes only; their sons received no direct instruction. The last two boys served as delayed treatment controls. They participated in all assessment procedures but did not receive behavioral treatment until the completion of the study.

As part of treatment the six treated subjects were gradually withdrawn from medication according to individualized schedules. Five of the six boys reached their goal of total withdrawal in an average of 8.4 weeks. The parents of one boy refused to continue withdrawing medication once he reached 33% of his original dose. The two control subjects remained on full medication throughout the study to provide information on the progress of hyperactive children receiving drug therapy only.

Subjects were assessed by a variety of measures over the 18 week period of the study. Three dependent measures provided time series data: classroom observations, School Notes, and Home Behavior Reports. Classroom observations

were conducted by trained nonparticipant observers three days per week using the Hyperactive Behavior Observation System (HBOS). The reliability of each observer was checked an average of once every 2.85 weeks. Percent agreement reliability averaged 95.2% across all codes and all observers. School Notes were completed by each boy's teacher at the end of the school day and provided a more global rating of classroom hyperactivity. Home Behavior Reports were completed by each boy's parents every evening and provided a measure of hyperactivity at home. Classroom observations, School Notes, and Home Behavior Reports were analyzed using visual inspection and Autoregressive Integrated Moving Average (ARIMA) procedures.

In addition to daily measures, a number of pre-post measures of academic achievement, cognitive functioning, self-esteem and physiological growth were administered. These data were analyzed using analysis of variance procedures.

Chapter Three

RESULTS

Data Analysis Procedure

Three types of data were collected continuously over baseline and treatment: classroom observations, teacher ratings of behavior at school, and parent frequency counts of negative behavior at home. These data were analyzed using the time-series methodology described by Parsonson & Baer (1978) and Gottman & Glass (1978). Graphs of the data were visually inspected to determine if there were significant changes during treatment in comparison to baseline. Where changes were detected in either level or slope, statistical analyses were conducted using the Autoregressive Integrated Moving Average (ARIMA) procedures described in Chapter Two. The ARIMA procedures were used to clarify if behavior during treatment was significantly different from behavior during baseline.

The results of data analysis procedures were interpreted somewhat differently than is usual in studies assessing the effect of a particular treatment for hyperactive children. Generally, treatment, whether drug or behavior therapy, is expected to <u>decrease</u> hyperactive behavior. Significant differences between baseline and

treatment indicate that the intervention is having an effect, that it is a successful therapy. This is an accurate interpretation if the subjects are given behavior therapy in addition to the psychostimulant medication they are currently taking. Decreases in hyperactive behavior could be interpreted as resulting from the new behavioral approach since drug therapy remained constant throughout baseline and treatment.

In this study, however, drug therapy did not remain unchanged throughout treatment: the amount of medication was gradually reduced. The six treatment subjects took their full prescribed doses of stimulants during baseline and took decreased doses once treatment began. This meant that behavior would probably be optimal during baseline, the period when the children were on 100% of their medications. If the behavioral treatment was successful at counteracting the decrease in medication, behavior would remain at the same level during treatment as it was during baseline. Nonsignificant differences between baseline and treatment would indicate that behavior therapy was having an effect. Although hyperactive behavior might not significantly decrease over treatment, the important fact is that it did not significantly increase. In short, if statistical analyses resulted in nonsignificant differences, the behavioral treatments tested in this study could be considered successful.

A second difference between this study and other treatment studies with hyperactive children is that in most studies, the treatment period is considered a single entity. Only one statistical analysis is performed: that which compares the mean before treatment to the mean after treatment. In this study, because gradual medication withdrawal was conducted concomitant to behavioral treatment, multiple statistical analyses were required. Treatment was divided into three phases for each of the six treatment subjects, based upon the amount of medication taken during the day. Analyses were performed to compare behavior during baseline to behavior during treatment when the child was on 100-50% of his medication (the T100-50% phase), on 49-25% of his medication (the T49-25% phase), and on 24% or less of his medication (the T24-0% phase). If there was a treatment phase during which behavior therapy was no longer as effective as medication in controlling the hyperactive behavior of the child, these multiple analyses would most probably uncover it. If a child could not be withdrawn entirely from medication, the minimum amount of the stimulant required to maintain his baseline level of behavior could be determined.

A specific procedure was developed to determine how much medication could be withdrawn from the six treatment subjects without resulting in a significant increase in hyperactive behavior. The same procedure was used for

Difference Scores, School Notes, and Home Behavior Reports, the three types of time-series data collected in this study. The procedure involved two steps: an overall treatment analysis and three or more phase analyses.

Overall Treatment Analysis

Data for each subject were individually graphed and visually inspected for changes in either level or slope from baseline to treatment. Data were subjected to statistical analyses to determine if any changes that occurred over the total 14 week treatment were significant (Baseline vs. Treatment). This analysis was the only one performed for the control, Subject 7, because his medication dosage remained the same throughout the entire treatment. Subject 8, also a control, did not adhere to his original dosage throughout treatment. On the advice of his physician and with the approval of his mother, his medication was increased to approximately double the amount of medication he was taking during baseline. This increase began during the seventh week of treatment and continued through week #10. During the eleventh and twelfth weeks of treatment, Subject 8 was returned to his original medication dosage. In week #13, his dose was again doubled and continued at this level through the remainder of treatment. The data for Subject #8 were divided into phases based on amount of medication taken, and special analyses were conducted to compare these various phases to baseline. Child 2, a

treatment subject, also did not adhere to his medication schedule. His parents withdrew medication as advised by the project staff until he reached 33% of his baseline dose. At this point, the parents began to increase, rather than continue decreasing his medication, so that by the end of treatment, he was taking 58% of his original dose. For this reason, special phase analyses were conducted on the data of Subject 2.

Phase Analyses

Phase analyses involved several steps. First, baseline data were compared to data from the first treatment phase, T100-50%, using visual inspection. If any changes in level or slope were detected, statistical analyses were performed to corroborate these changes and to determine if they were significant. If significant changes occurred at the T100-50% phase, it meant that the child could not be withdrawn from any amount of medication without a deterioration in behavior. Further phase analyses were terminated in this case.

If no significant changes occurred at the T100-50% phase, phase analyses continued. Baseline data were visually compared to data from the first two treatment phases, T100-50% and T49-25%. Again, if changes were visually apparent, statistical analyses were performed, this time comparing baseline data to treatment data up to the point the child was withdrawn from all but 25% of his

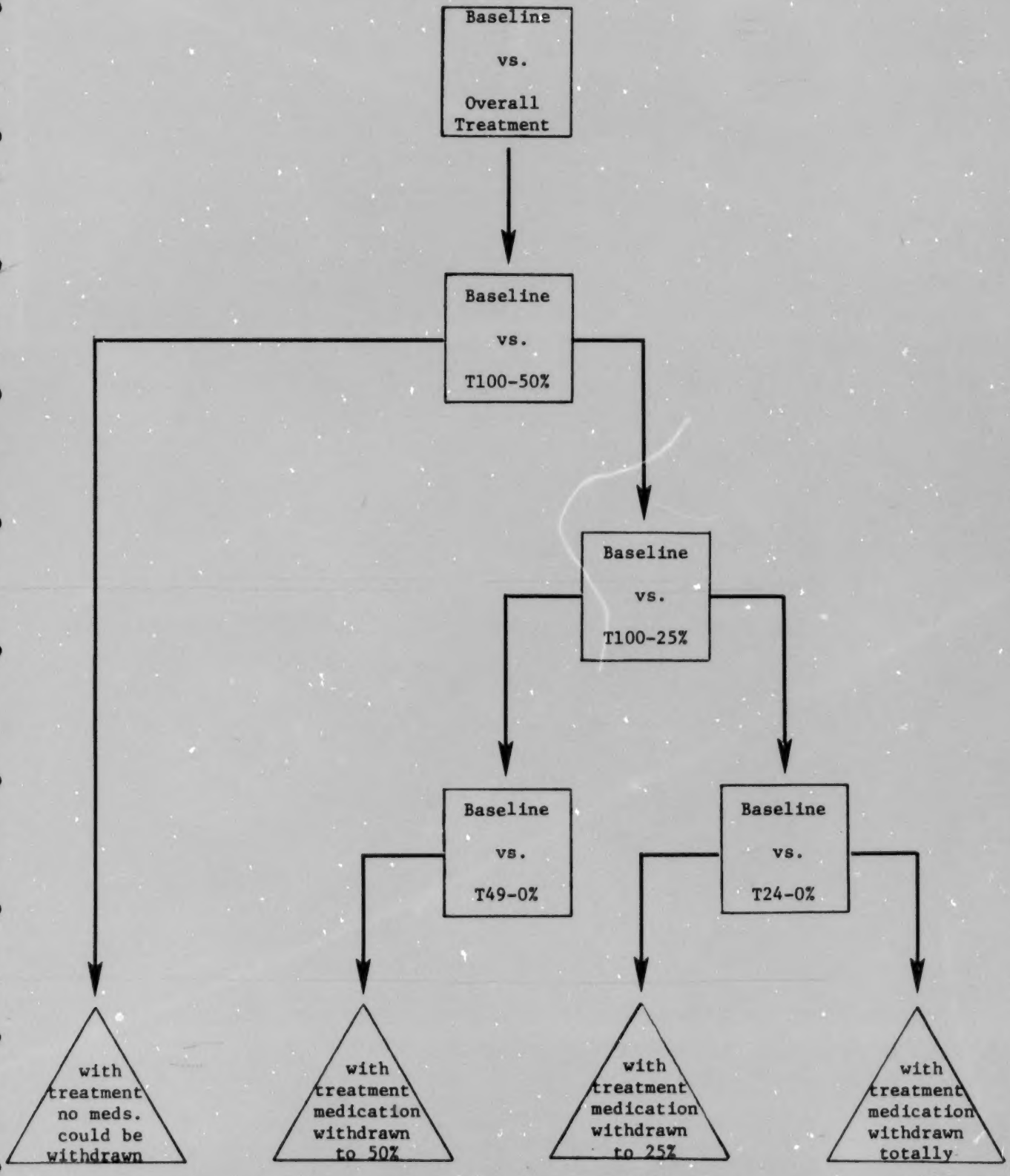
medication (T100-25%). If significant changes occurred during these two phases, it was assumed that somewhere between 49% and 25% of his medication the child became significantly more hyperactive than during baseline. To test this assumption, a statistical analysis was performed comparing baseline to treatment data when the child was taking 49% or less of his medication (T49-0%). If this test was significant, the child could be withdrawn from 50% of his medication using a behavioral treatment.

If the results of the baseline vs. T100-25% test were nonsignificant, phase analysis was continued. Baseline data were compared to data in the last treatment phase, T24-0% to decide if any differences in behavior when the child was on less than 25% of his original dose were significant. If significant, it was concluded that with treatment, total withdrawal of medication could be accomplished. A diagram of the data analysis procedure described above appears in Figure 4.

A variety of different data analysis procedures could have been used to test if behavioral changes occurring at various treatment phases were significant. The particular procedure described above was chosen for two reasons. First, it was the most economical. That is, the procedure required a small number of tests to determine at what point in treatment there was a significant behavior change.

Figure 4

Diagram of Data Analysis Procedure



Second, this procedure was the most fitting to use with time-series data since it allowed the analysis of phase data as part of a continuous trend, rather than in isolation. Using this procedure, the T49-25% phase was never directly compared to baseline. This phase was always tested as part of either the T100-25% or T49-0% phase. Changes in isolated phases such as T49-25% were not of interest in themselves, but only as part of a continuous trend.

This data analysis procedure did have a limitation: the longer the treatment phase being compared to baseline, the greater the possibility that changes occurring in isolated phases would be obscured. For example, a significant improvement or deterioration in behavior during the T49-25% phase might not surface when the scores during baseline and the longer T100-25% phase were compared. To compensate for this problem, mean scores were inspected for each subject to detect any large change during the T49-25% phase. If such change occurred, further analyses were performed to isolate the most probable point at which behavior showed a significant improvement or decline.

Baseline Data

The purpose of this study was to find out if withdrawing medication, while providing a behavioral treatment, would maintain behavior at the same level as recorded during baseline. Since baseline data served as the standard against which treatment data were compared, the pattern of baseline data was of considerable import.

Ideally in intensive design research, baseine data are collected until there is a stable pattern in the data before treatment is begun. In this study, this ideal was attained for seven of the eight subjects on all three types of data. The only exception was the Home Behavior Report data for Subject 4. The number of negative behaviors per hour he displayed at home showed a significant upward drift across baseline. This positive trend indicated that his behavior as observed by his parents was getting worse during the four weeks preceding treatment. Although drift in baseline is problematic when interpreting the results of ARIMA analyses, a trend toward increasing hyperactivity in this study is of less concern because the bias is against treatment. Treatment would have to exert a powerful effect over Subject 4's home behavior to counteract the significant trend toward increasing hyperactivity.

Table 14 presents trend data during baseline for all eight subjects. A positive trend in observed Difference Scores (e.g. .31) indicates that the behavior of the subject got worse during baseline in comparison to other children in his classroom. Conversely, a negative trend in Difference Score (e.g. -.31) indicates that the subject got better behaved as baseline progressed. A positive trend in School Note data indicates that the subject got increasingly better teacher ratings during baseline and a negative trend indicates that he got increasingly worse School Notes. Home

TABLE 14

TRENDS IN BASELINE DATA

	Observed Class Behavior Difference Scores			Teacher School Notes			Parent Home Behavior Reports		
Subject	trend	t	df	trend	t	df	trend	t	df
1	- .31	-1.00	36	.03	.14	55	.00	- .04	100
2	.31	-1.47	36	- .75	-1.68	60	- .17	-1.92	115
3	- .02	- .14	46	- .21	-1.42	68	.01	.48	121
4	.09	.57	39	.43	1.61	62	.04	2.01*	112
5	.08	.88	43	.09	.39	69	- .07	-1.23	114
6	- .08	-1.02	40	.13	.74	69	.02	.66	94
7	.19	1.29	41	- .13	- .36	65	- .04	-1.67	115
8	.06	.41	39	- .05	- .25	46	- .02	- .25	92

Note. A * indicates significant drift in baseline data at the $p < .05$ level. Degrees of freedom differ depending on the frequency of measurement. Class observations were made three days per week, School Notes were completed five days per week and Home Behavior Reports were made seven days per week. Differences in df between subjects on the same dependent measure are due to lagged treatment, absences of subjects or observers, or incomplete data provided by parents or teachers.

Behavior Report data follow the same pattern as observed Difference Score data: the more negative the trend, the better behaved the subject and the more positive the trend, the worse behaved he became during baseline. Except for Subject 4 on Home Behavior Reports, no trends in baseline data were significant. In short, the stability in baseline data provided a nonbiased standard upon which to evaluate subsequent behavior.

Changes in Classroom Behavior: Observations

Behavioral observations of classroom hyperactivity were the most objective of the time-series measures employed in this study. Observers were naive to the nature and purposes of the study, in contrast to other data collectors such as parents and teachers. Because of the greater objectivity of these data, results from observations will be presented first.

The Meaning of Difference Scores

Three days per week the eight subjects in this study and comparison children in their classrooms were observed using the Hyperactive Behavior Observation System (HBOS). Each observation resulted in two scores per subject: the per minute amount of off-task, out-of-seat, fidgeting, locomotion, verbalization, and noise for the target child and this same score for comparison children. These per minute figures were used to calculate a Difference Score which represented how similar the hyperactive child's

behavior was to that of comparison peers in his classroom. A Difference Score of 0 indicated that behavior of the hyperactive child was indistinguishable from that of his peers. A positive Difference Score indicated that the hyperactive child displayed more negative behaviors per minute than his peers. Conversely, a negative Difference Score indicated that the target child demonstrated less hyperactivity than his peers. The Difference Score put the negative behavior of the hyperactive child in perspective by comparing it to a behavioral norm for a particular classroom on a given day.

Effects of Treatment on Difference Scores

Central tendency measures of Difference Score data are presented in Table 15. This table reports means and standard deviations for each treatment subject during baseline, overall treatment, the three phases within treatment, and any special phases appropriate for the individual child. Since the design of this study required that control subjects remain on full doses of medication over the entire treatment, means and standard deviations for Subjects 7 and 8 are reported during baseline and overall treatment only. No phase data were collected for control subjects, except special phase data for Subject 8.

Four points should be made about the data in Table 15. First, the negative Difference Scores of four subjects during baseline indicates that these subjects were better

TABLE 15

MEANS AND STANDARD DEVIATIONS OF DIFFERENCE SCORES BY TREATMENT PHASE FOR EXPERIMENTAL (1-6) AND CONTROL SUBJECTS (7-8)

	Baseline		T100-50%		T49-25%		T24-0%		Special Phases		Overall Treatment	
Subject	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	-1.00	1.79	.02	2.94	.56	1.91	.88	.38			.41	2.18
2	- .79	1.11	- .45	1.27	- .11	.98	-	-	-1.06	1.78[a]	- .47	1.30
3	- .58	1.54	- .35	2.16	.86	2.39	2.78	1.83			.86	2.48
4	.88	1.94	.05	2.30	.84	.98	1.48	1.80			.70	2.08
5	1.01	1.32	.26	.93	1.18	1.39	.82	1.57			.65	1.31
6	-1.14	1.18	-1.24	.98	.18	.43	.45	1.30			-.14	1.37
7	.11	1.70	-	-	-	-	-	-			.35	1.01
8	2.24	1.69	-	-	-	-	-	-	2.40 1.05	1.24[b] 1.94[c]	1.67	1.78

Note. A negative value (e.g., -1.00) indicates the subject was less hyperactive than comparison children in his class; a positive value indicates the subject was observed to be more hyperactive.

[a] Days Subject 2 received 50% or more of his original dose.

[b] Days Subject 8 received 200% of his medication for the first time.

[c] Days Subject 8 received 200% of his medication for the second time.

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behaved than comparison peers in their respective classrooms. Perhaps the dosages of medication for Subjects 1, 2, 3 and 6 caused them to be over-controlled in their classroom behavior.

Second, inspection of means across phases shows that in most cases there was a gradual increase in means as treatment progressed. Four of the six treatment subjects became most hyperactive in the phase when they were on the least amount of medication, the T24-0% phase.

Third, Table 15 clarifies that variability as measured by standard deviations was relatively high for the subjects in this study. These boys did not demonstrate a consistent pattern of negative behavior. Instead, they exhibited both extremes on the behavioral continuum. They seemed to have especially "good" and especially "bad" days as compared to other boys in their classes.

A final point regards the two control subjects. The means and standard deviations for Subject 7 were relatively stable during the course of the study. This boy's Difference Scores indicated that on full medication he behaved very much like the other boys in his class and that his behavior did not change much over the 17 weeks. In short, he provided the type of data one would expect from a control child who received no treatment and remained on his same medication dosage. However, this was not true of control Subject 8. His behavior was much more variable.

The first two week period during which he took 200% of his original medication (Special Phase B), he behaved very much the same as when he was on 100%. The next period during which his dose was again increased to 200% (Special Phase C), his behavior improved substantially over previous levels. In short, he provided somewhat unexpected data for a control subject.

To determine whether changes in Difference Scores between phases were significant, visual inspection and statistical analyses of the data were performed. Graphs of Difference Scores are displayed in Figure 5. Results of visual inspection and ARIMA analyses of these data are presented in Table 16. For Subjects 1 - 6, this table reports the results of comparisons of baseline to overall treatment, to treatment plus medication reduction to 50%, to treatment plus medication reduction to 49-25%, to treatment plus medication reduction to 24-0%, and to treatment plus special medication phases. For control subjects who were neither treated nor withdrawn from medication, Table 16 reports comparisons of baseline to overall treatment and to appropriate special medication phases.

In presenting the results of the ARIMA analyses, the sign is used to indicate the direction of change : a + sign means that behavior improved significantly during this phase; a - sign means that behavior became significantly more hyperactive during this phase. The proportion

Figure 5

Difference Scores

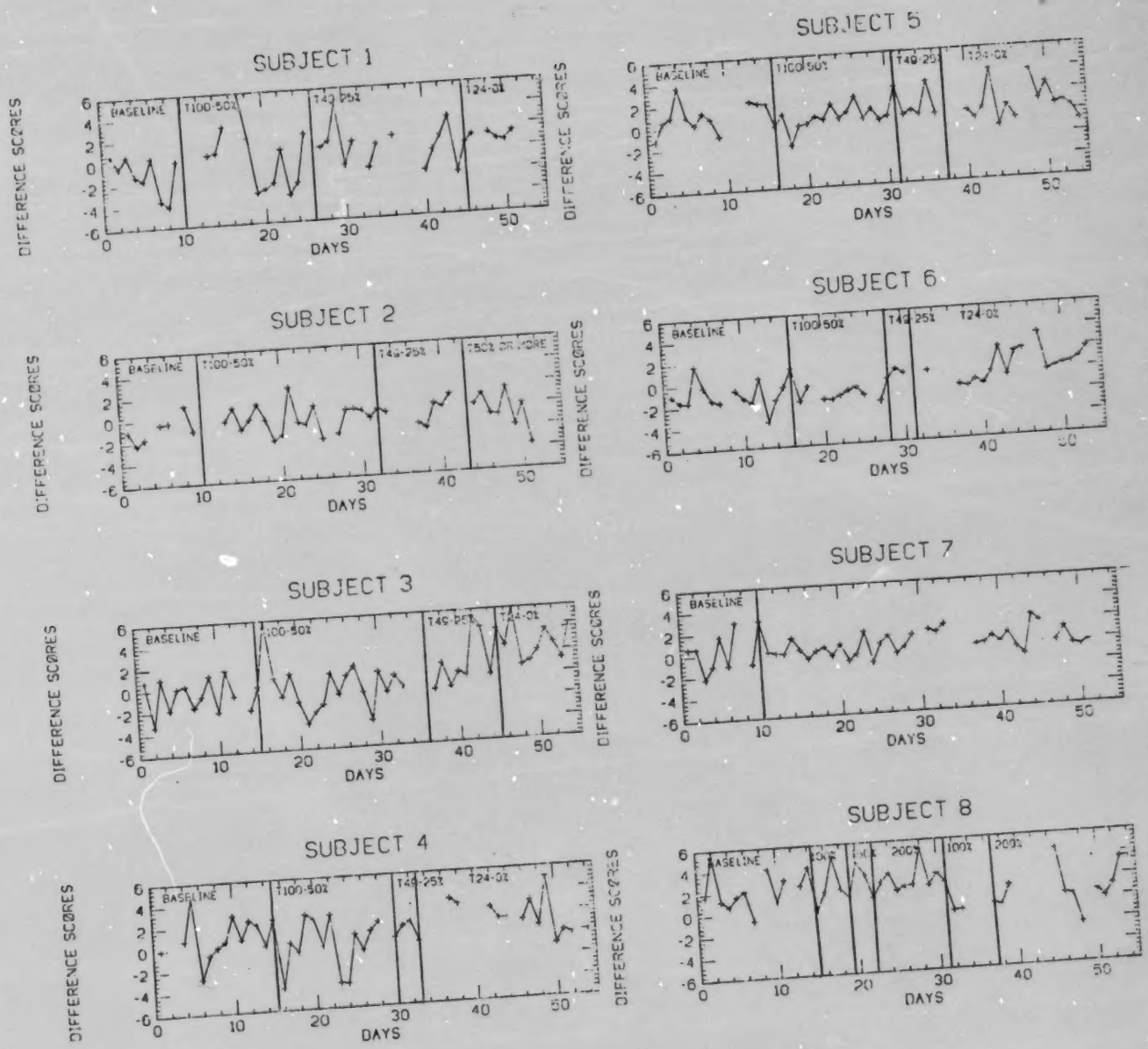

Table 16

Results of Visual Inspection and ARIMA Analyses of Difference Scores

Subjects		Baseline vs. Treatment	Baseline vs. T100-50%	Baseline vs. T49-25%	Baseline vs. T24-0%	Baseline vs. Special Phases
1	Δ Level	NS	NS	- $p < .01$ →		
	Δ Slope	NS	NS	- $p < .05$ →		
2	Δ Level	NS	NS →		--------	NS[a]
	Δ Slope	NS	NS →		--------	+ $p < .05$[a]
3	Δ Level	- $p < .10$	NSVI	- $p < .001$ →		
	Δ Slope	NS	NSVI	NS →		
4	Δ Level	NS	NSVI →		NS	
	Δ Slope	NS	NSVI →		+ $p < .05$	
5	Δ Level	NS	NS →		NS	
	Δ Slope	NS	NS →		NS	
6	Δ Level	NS	NS →		- $p < .01$	
	Δ Slope	- $p < .05$	NS →		NS	
7	Δ Level	NS	--------	--------	--------	
	Δ Slope	NS	--------	--------	--------	
8	Δ Level	NS	--------	--------	--------	NSVI[b] NS[c]
	Δ Slope	NS	--------	--------	--------	NSVI[b] NS[c]

Note. A "+" sign indicates that behavior improved.

A "-" sign indicates that behavior became more hyperactive.

NSVI indicates that changes were nonsignificant by visual inspection.

[a]Days Subject 2 received more than 50% of his original dose.

[b]Days Subject 8 received 200% of his medication for the first time.

[c]Days Subject 8 received 200% of his medication for the second time.

indicates the probability of the observed change. Since behavior during treatment phases could have become better or worse, two-tailed t test probability values are reported for all ARIMA analyses.

The first column in Table 16 presents the results of comparing baseline level and slope data to level and slope data for the entire treatment. For control subjects, this is a meaningful analysis, since they received no treatment and would not be expected to show significant changes over time. For treatment subjects, however, this global comparison is probably not the most informative one because it does not take into account the variable doses of medication administered throughout the lengthy treatment. Only one of the six treatment subjects, 6, showed any significant change in Difference Score according to the Baseline vs. Treatment analysis. Means and standard deviation data in Table 15 indicate that perhaps more detailed phase analyses would result in different conclusions.

The remaining data in Table 16 report the results of the phase analyses. The second column presents the findings when baseline level and slope data were compared to level and slope data during the first phase of treatment, when subjects were administered between 100 and 50% of their medications. There were no significant changes in Difference Scores during this phase of treatment. All six

treated subjects were withdrawn from at least one-half of their current medications without adverse effects on their classroom behavior.

Further review of Table 16 makes it clear that the withdrawal of more than 50% of the child's medication increased the likelihood that classroom behavior became significantly more hyperactive. Four subjects showed no significant differences at T49-25%, but two did. Subject 1 showed a deteriorating level and slope in his data at T49-25%. Subject 3 showed a highly significant increase in the level of his hyperactivity at this phase of treatment ($p < .001$). For these two boys, the combined self-control and behavior management treatment seemed powerful enough to permit the withdrawal of 50% of their medication, but no more.

However, the baseline data for subjects 1 and 3 make interpretation of these results somewhat less clear. Both boys had large negative Difference Scores at baseline. They began this study on doses of medication that controlled their behavior so well that they acted appreciably <u>less</u> hyperactive than their "normal" peers. As treatment progressed and medication was withdrawn, Subjects 1 and 3 began to act more like other students in their classes. Although these changes were statistically significant, they appear not to be clinically significant. That is, although their behavior is significantly worse at the T49-25% phase

than it was during baseline, it is still not aberrant when compared to the behavior of their classroom peers. It is probably not until the T24-0% phase that the behavior of these two boys becomes clinically deviant. It is then that the mean Difference Scores show marked changes; from -1.00 at baseline for Subject 1 to .88 and from -.58 to 2.78 for Subject 3.

The fourth column in Table 16 presents the results of comparing baseline data to data during the final phase of treatment, when subjects were administered less than 25% of their original doses of medication. At T24-0%, Subject 6 showed significant deterioration in his classroom behavior. Another, Subject 4, showed a significant slope change during this phase, indicating that his behavior was getting increasingly <u>better</u>. Subject 5 showed no significant differences between behavior at baseline and behavior during the final treatment phase. The data for Subject 2 could not be analyzed for the baseline vs. T24-0% phase because he was never administered less than 33% of his medication.

Special phase analyses were required because the parents of two subjects did not follow the original research design. For Subject 2, withdrawal of medication was halted by the parents at week #15 and his dosage was increased to 50% of his original amount. An ARIMA analysis was conducted to determine whether his behavior changed significantly between baseline and the T50% or more treatment phase.

Results showed a positive slope change but no level change. A similar situation occurred with the parent of Subject 8, who began giving her son 200% of his original dose of medication at two different points in treatment. The statistical analyses resulted in no significant differences in behavior between baseline, when the child was taking 100% of his medication, and either the first or second T200% phase. For this boy, twice his daily dose of stimulants did no more to control his classroom behavior than the original prescribed amount.

Summary of Observational Data

With behavioral treatment, two subjects were successfully withdrawn to 50% of their original medication dose without demonstrating any significant increase in hyperactivity. One subject was successfully withdrawn to 33% of his original dose and another to 25% of his original dose. The remaining two subjects were completely withdrawn from stimulant medication without adverse effects. Both control subjects, one of whom remained on his original dose and the other who increased his dose to 200%, showed no significant changes in observed classroom behavior during treatment. Their observed hyperactivity neither increased nor decreased over the course of the study.

Changes in Classroom Behavior: Teacher Ratings

The teachers who provided data in this study were not naive to its purposes and goals. The six who taught

Subjects 1 - 6 knew that these boys were being given a behavioral treatment and that in addition, they were being gradually withdrawn from their stimulant medications. The two teachers of the controls, Subjects 7 and 8, knew that these boys were not being given any treatment and that their medication dose remained the same over the entire study. Because of their knowledge, teachers were considered potentially biased in evaluating subjects. However, the information they provided was viewed as essential. Teachers offered a global perception of the child's behavior throughout the entire school day, rather than a sampling of his behavior taken during a short period of his day.

Because teachers might have been biased in their ratings of classroom behavior, correlational analyses were performed on the data to measure the extent to which classroom observations and teacher perceptions agreed. Although correlations between rating scales of hyperactivity and behavioral observations of hyperactivity have been reported to be low (Whalen et al., 1978), results in the present study found higher relationships. Correlations between each subject's Negative Behavior Score for a given day and the score he received on his School Note for that same day are presented in Table 17. Correlations for five of the subjects reached significance at the $p < .05$ level. The correlation of Difference Scores and School Note Scores for all eight subjects combined was $-.36$, $p < .001$. With

TABLE 17

CORRELATION BETWEEN THE NEGATIVE BEHAVIOR SCORES RECORDED BY CLASSROOM OBSERVERS AND TEACHER RATED SCHOOL NOTE SCORES FOR THE SAME DAY

Subject	r	p Value
1	- .56	< .001
2	- .23	< .001
3	- .42	< .01
4	- .31	< .05
5	- .21	.08
6	- .27	< .05
7	- .16	.15
8	- .02	.47

Note. The lower the Negative Behavior score, the better the subject behaved. The lower the teacher rated School Note score, the worse the subject behaved. Therefore, a negative correlation coefficient indicates the degree to which classroom observers and teachers agreed on the subject's behavior during the study.

the exception of Subject 8, for whom observed and rated behavior correlated only minimally, it appears that the teachers in this study were fairly accurate observers of the hyperactive boys in their classes, at least as compared to the observation data of classroom observers. Note, however, that while statistically significant relationships were found, most of the variance was not accounted for by the two measures. A correlation coefficient of -.56, the highest correlation for any of the subjects, still leaves approximately 75% of the variance unexplained (-.56 squared minus 100).

The Meaning of School Note Scores

Every school day, the teachers of each of the eight subjects in the study filled out a School Note, rating the boy's performance on 4 or 5 positive classroom behaviors. Ratings ranged from 5 to 25: the higher the score, the better the behavior. If behavioral treatments were as effective as medication in controlling the hyperactive child's behavior in class, School Note scores should have remained the same or increased during treatment.

Effects of Treatment on School Note Scores

Central tendency measures of School Note data are presented in Table 18. Baseline scores indicate that on full medication, six of the eight subjects showed moderate School Note scores. They ranged from 12.10 to 19.11 out of a possible 25 points. Two subjects, however, displayed

Table 18

Means and Standard Deviations of School Notes by Treatment Phase

Subjects	Baseline		T100-50%		T49-25%		T24-0%		Special Phases		Overall Treatment	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	23.59	2.37	21.90	3.35	21.98	2.59	17.71	2.43			21.38	3.19
2	16.90	3.84	18.30	4.47	12.72	3.98	-----	----	15.63[a]	6.78[a]	15.96	5.36
3	14.50	2.75	13.29	2.77	13.45	1.64	10.05	3.27			12.36	3.11
4	12.10	6.02	12.60	5.33	12.90	5.27	14.72	4.57			13.50	5.03
5	15.63	4.61	19.87	2.68	17.47	3.68	14.48	6.01			17.27	5.07
6	19.11	4.40	22.66	2.74	15.30	6.00	21.01	3.40			21.03	3.96
7	14.42	4.32	-----	----	-----	----	-----	----			15.65	3.85
8	7.17	1.71	-----	----	-----	----	-----	----	10.00[b]	7.34[b]	10.48	5.25
									13.13[c]	3.22[c]		

[a] Days Subject 2 received 50% or more of his original dose.

[b] Days Subject 8 received 200% of his medication for the first time.

[c] Days Subject 8 received 200% of his medication for the second time.

extreme mean scores during baseline, one high and one low. Subject 1, a treatment child, had a mean of 23.59. As judged by his teacher, his behavior in class was "near perfect". At the other extreme was Subject 8, a control child, who had a mean of 7.17. Since the mimimum score on School Notes was 5.00, this boy's behavior in class was rated by his teacher as being almost the "worst possible".

The fact that a treatment child began intervention with an extremely high (positive) baseline score and that a control child displayed an extremely low (negative) baseline score is somewhat bothersome for this particular research study. Regression to more moderate levels was likely in both these boys' data. Subject 1 would likely decrease his mean School Note score, no matter how effective the treatment, and Subject 8 would likely increase his score, despite the lack of treatment. For this reason, caution must be exercised in interpreting the ARIMA results for Subjects 1 and 8.

Graphs of School Note scores are displayed in Figure 6. Results of visual inspection and statistical analyses performed on School Note data are reported in Table 19. As with Difference Scores, five comparisons are summarized: one comparing baseline to overall treatment, three comparing baseline to the various phases of treatment, and one comparing baseline to special phases during treatment.

Figure 6

School Note Scores

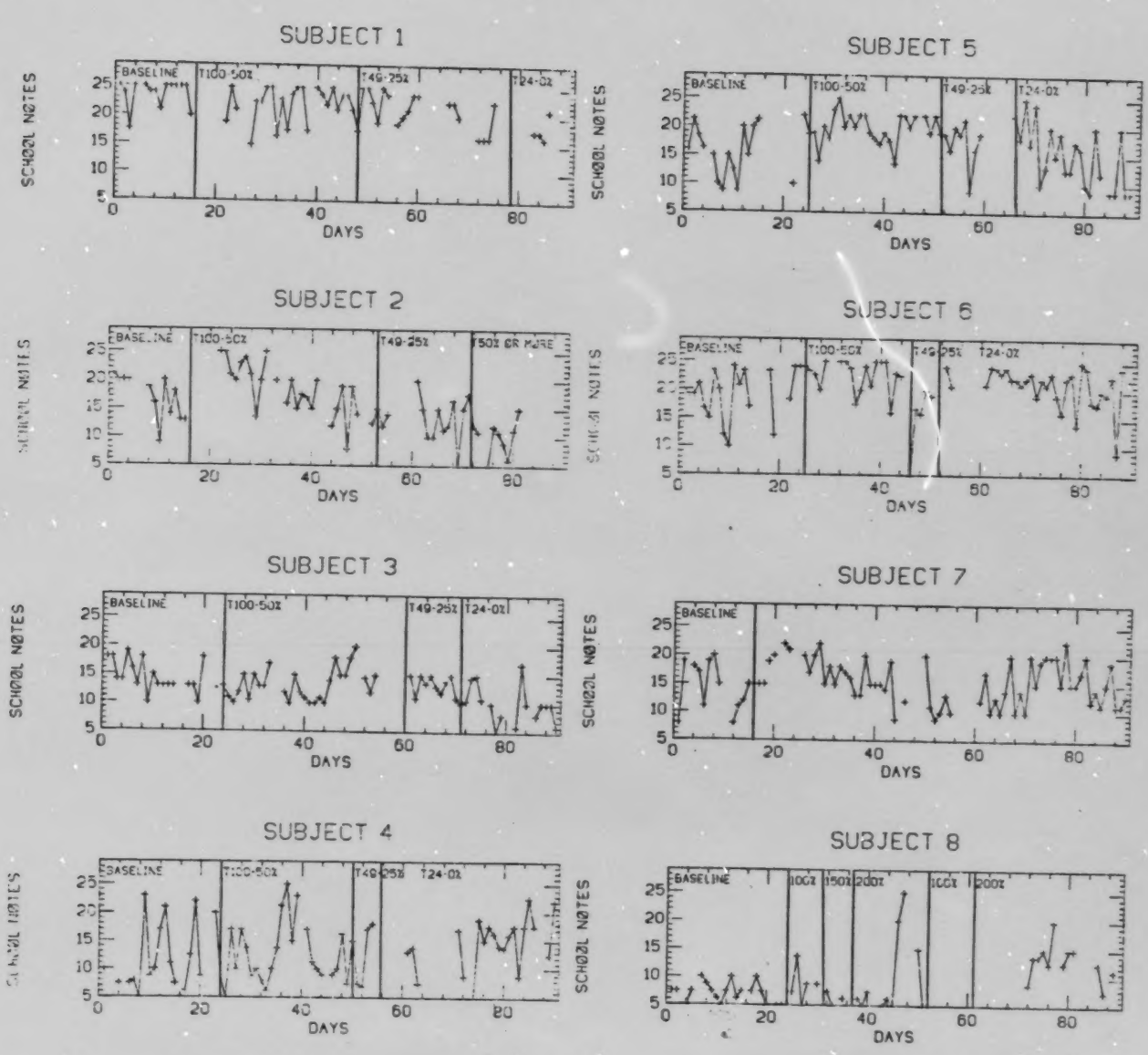

Table 19

Results of Visual Inspection and ARIMA Analyses of School Notes

Subjects		Baseline vs. Treatment	Baseline vs. T100-50%	Baseline vs. T49-25%	Baseline vs. T24-0%	Baseline vs. Special Phases
1	Δ Level	- $p < .05$	- $p < .05$ →	→	→	
	Δ Slope	NS	NSVI	NS →	→	
2	Δ Level	NS	NS →	→	———	NS[a]
	Δ Slope	NS	NS →	→	———	+ $p < .001$[a]
3	Δ Level	- $p < .05$	NS →	→	- $p < .001$	
	Δ Slope	NS	+ $p < .05$ →	→	NS	
4	Δ Level	NS	NSVI →	→	NS	
	Δ Slope	NS	NSVI →	→	NS	
5	Δ Level	NS	+ $p < .01$ →	→	NS	
	Δ Slope	NS	NS →	→	- $p < .05$	
6	Δ Level	NS	+ $p < .01$	NS →	→	
	Δ Slope	NS	NS	- $p < .05$	NS	
7	Δ Level	NS	———	———	———	
	Δ Slope	NS	———	———	———	
8	Δ Level	NS	———	———	———	NS[b] + $p < .001$[c]
	Δ Slope	NS	———	———	———	NS[b] NS[c]

Note. A "+" sign indicates that behavior improved.
A "-" sign indicates that behavior became more hyperactive.
NSVI indicates that changes were nonsignificant by visual inspection.

[a]Days Subject 2 received more than 50% of his original dose.
[b]Days Subject 8 received 200% of his medication for the first time.
[c]Days Subject 8 received 200% of his medication for the second time.

The first column in Table 19 reports the results of the comparison between level and slope data during baseline to level and slope data for overall treatment. As was true of Difference Score data, both control subjects showed no significant changes in their School Note scores over time. This was the expected pattern since they received no treatment. Of the six treated subjects, two (Subjects 1 and 3) showed significant declines in their School Note scores over the 14 week treatment. These subjects became more hyperactive over the period of behavioral intervention as perceived by their teachers. The behavior of the other four treatment subjects did not change significantly over the entire treatment.

The next portion of Table 19 presents the results of baseline versus T100-50% comparisons for the six treatment subjects. Whereas for Difference Score data, no treatment subjects showed any significant changes in behavior either in the positive or negative direction during the T100-50% phase, this was not the case for School Note data. Teachers perceived changes in four of the six subjects during the initial phase of treatment: three subjects got significantly better in slope or level (Subjects 3, 5, and 6) and one got significantly worse (Subject 1 in level). For Subjects 1, 3, & 5, these changes from baseline persisted through the T49-25% phase and no additional changes occurred until medication was decreased to less than 25%.

The fourth column in Table 19 summarizes the results of comparing baseline data to data during the final phase of treatment. At 24-0%, Subject 1 continued to show a significant increase in hyperactive behavior over the level he demonstrated at baseline. Subjects 3 and 5 who had shown decreases in hyperactivity during previous phases now showed increases in hyperactivity in terms of level or slope changes. Two subjects, 4 and 6, showed no changes over baseline even in this last phase of treatment. Subject 2's data could not be analyzed for baseline vs. T24-0% phase because he discontinued drug withdrawal at 33% of his original dose.

It should be pointed out that Subject 6 showed a significant deterioration in school behavior during the T49-25% phase. The decline in School Note scores is apparent in his means data (Table 18), on his graph (Figure 6), and in the results of ARIMA analyses (Table 19). His level, which had been increasing, dropped precipitiously at this phase and his slope showed a significant decline. In the following phase, T24-0%, Subject 6's behavior returned to the high levels of the T100-50% phase. It appears that his short-lived decline in behavior was a fluke, caused, most likely, by one or two low data points in an unusually short treatment phase (five points in total). If we consider the pattern of his data across the entire treatment, we would most probably conclude that Subject 6

can be withdrawn from 100% of his medication without adverse effects on his beahavior at school.

The last results in Table 19 are the comparison of baseline scores to scores obtained during special medication phases. During his T50% or more phase, Subject 2 showed a highly significant, positive slope change. That is, when he began increasing his medication to 50% and more, the teacher perceived his behavior as getting better. During Subject 8's first T200% phase, there were no significant changes in his School Note scores. During the second T200% phase, however, his scores significantly increased in level. His teacher rated him as markedly improved during this period.

The significant changes in Subjects 2 and 8 during special phases is somewhat puzzling since both boys had previously taken amounts of medication equal to those administered during the special phases without displaying any significant changes in behavior. An explanation for the discrepancy in Subject 8's data is the possibility that the drug he was given (pemoline) required several weeks to build up significant blood levels to produce an effect on his behavior. Perhaps the first three week period when he took 200% of his medication was not long enough to attain such high blood levels. The second, much longer period might have been adequate time to reach these levels. If this were the case, we would have expected to see a rise in School Note scores sometime after the first three weeks during the

second T200% phase. Unfortunately, because most of Subject 8's School Notes for weeks #11 through #15 were either lost by the child or misplaced by the mother, visual inspection of the graph of Subject 8's data could not confirm this hypothesis.

Subject 2's significant slope change at the T50% or more phase cannot so readily be explained by medication blood levels. During much of the first phase of treatment (T100-50%), the amount of stimulant medication in his body was much greater than that present during the special phase, T50% +. A more plausible explanation was probably that expectancy played a role in improving the behavior of this child in class. When subject 2 realized his medication dosage was increasing, rather than decreasing to previously untried amounts, he expected to be better able to control himself. Anecdotal data lend some support to this hypothesis. The parents, teacher, and principal of this child expressed great fear during the last part of medication withdrawal. They felt that if his dosage were decreased to less than 10 milligrams per day (33% of his original dose), the boy would "fall apart." When the parents began increasing the dosage to what they felt to be a "safe" amount (15 milligrams per day), they expressed a sense of relief as did the boy's teacher. Perhaps their feelings were communicated to the child and actually resulted in decreased hyperactivity. Or perhaps there was

no decrease in hyperactivity but only the perception of the teacher that the boy had improved.

Summary of Teacher Rating Data

Two subjects were completely withdrawn from stimulant medication without adverse effects on teacher-rated classroom behavior. Two subjects were successfully withdrawn to 25% of their original medication dosage, and one subject to 33% without their teachers perceiving any significant increase in hyperactivity. The last subject was unable to be withdrawn from any amount of medication without his School Note scores showing a marked decline. The control subject who remained on his original dose of medication over the entire intervention showed no significant changes in behavior as rated by his teacher. The other control subject received significantly improved School Note scores during one of the periods when his medication dose was increased to 200%.

Comparison of Difference Score and School Note Data

A comparison of Tables 16 and 19 shows that School Note scores followed similar patterns to Difference Scores. Data gathered by observers and teachers concurred regarding the effects of treatment on Subjects 2, 4, 7 and 8. Teacher ratings were more sensitive to the effects of medication withdrawal than observational measures for Subjects 1 and 5 and less sensitive for Subjects 3 and 6. That is, observational data indicated that Subject 1 could be

withdrawn from 50% of his medication with no significant changes whereas School Note scores indicated that no amount of medication could be withdrawn. Conversely, observational data showed that Subject 3 could be withdrawn to 50% of his medication whereas the teacher did not note a significant decrease in positive behavior until withdrawal approached less than 25%.

Results from the two different sources of classroom behavioral data were generally consistent regarding the effects of treatment. For Subjects 4, 5, and 6, behavior therapy was powerful enough to counteract the withdrawal of a minimum of 75% and generally as much as 100% of their medication. For Subject 2, the behavioral intervention allowed withdrawal from at least 66% of his medication, perhaps more, if withdrawal had been allowed to continue. For Subjects 1 and 3, behavior therapy appeared effective in replacing approximately 50% of their medication.

Changes in Home Behavior: Parent Frequency Counts

Parents were a major focus of the behavioral treatments tested in this research study. For this reason, data were gathered on a daily basis to provide information on the behavior of the subjects in the home environment as well as at school.

The Meaning of Home Behavior Report Scores

Currently available parent rating scales of hyperactivity such as the Werry-Weiss-Peters and Conners

(described in Chapter One) were considered for use in this study as the measure of home behavior. However, because of their global, subjective nature and their low reliability upon repeated administration, such rating scales were avoided. Instead, daily counts of negative behavior were chosen as the measure of home behavior change. Each day the child's parents tallied the number of times their son displayed each of ten negative behaviors. The specific behaviors they observed throughout the day were selected by them based on the individual problems of their boy. Behaviors were clearly defined to insure accurate recording. A list of the ten behaviors for each of the subjects appears in Appendix G.

The average number of problem behaviors per hour was calculated each day based on how many negative behaviors a child demonstrated and how many hours he spent with his parent(s). The range of daily scores was from 0 to 10 negative behaviors per hour. The higher the score, the more hyperactive the child acted at home that day.

Effects of Treatment on Home Behavior Report Scores

Table 20 provides central tendency measures of Home Behavior Report data. During baseline, Subjects 1 - 6 demonstrated between 1.38 and 2.86 negative behaviors per hour. The most extreme mean scores were those of the two control subjects. Subject 7, with a mean of .81, presented the fewest behavior problems at home, as reported by his

TABLE 20

MEANS AND STANDARD DEVIATIONS OF HOME BEHAVIOR REPORT SCORES BY TREATMENT PHASE

	Baseline		T100-50%		T49-25%		T24-0%		Special Phases		Overall Treatment	
Subject	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
1	1.38	1.12	1.02	.82	1.95	1.05	2.40	1.28			1.74	1.15
2	2.86	2.00	2.55	2.44	2.36	2.70	-	-	1.61[a]	2.35[a]	2.44	2.43
3	1.61	.64	1.29	.84	.95	.52	.89	.55			1.11	.74
4	1.53	1.20	1.45	1.06	1.05	.82	.90	.63			1.14	.88
5	2.68	2.85	2.70	2.81	2.12	2.07	3.16	2.70			2.72	2.65
6	1.83	1.29	1.28	1.19	1.40	.65	1.05	1.04			1.18	1.07
7	.81	.83	-	-	-	-	-	-			.84	.62
8	4.02	2.63	-	-	-	-	-	-	5.86[b] 2.19[c]	3.85[b] 1.53[c]	4.11	3.10

[a] Days Subject 2 received 50% of more of his original dose.

[b] Days Subject 8 received 200% of his medication for the first time.

[c] Days Subject 8 received 200% of his medication for the second time.

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parents. Subject 8, with a mean of 4.02 negative behaviors per hour, presented the highest average number.

Table 20 shows that across treatment phases, three subjects actually became increasingly better behaved at home. One subject became worse and two treatment subjects showed variable patterns of change in their mean scores. Graphs of Home Behavior Report data are presented in Figure 7. Results from visual inspection of these data and ARIMA analyses are summarized in Table 21.

A major point needs to be made regarding the overall analyses of home behavioral data. Whereas in analyses of classroom behavioral data, level and trend changes were more frequently in the negative direction, home data show an opposite trend. That is, as the 14 week treatment progressed, subjects often became <u>better</u> behaved at home.

Results from phase analyses corroborate this general finding. Three subjects showed large decreases in the amount of hyperactive behavior they displayed at home as demonstrated by their significant level changes. For two of these Subjects, 3 and 6, this sharp decrease in hyperactivity came during the last phase of treatment, when they were taking less than 25% of their original medication doses. The third, Subject 4, demonstrated improved behavior earlier in treatment, during his T49-25% phase. Two of these subjects showed improvement at home after their parents received approximately five of the eight lessons in

Figure 7
Home Behavior Report Scores

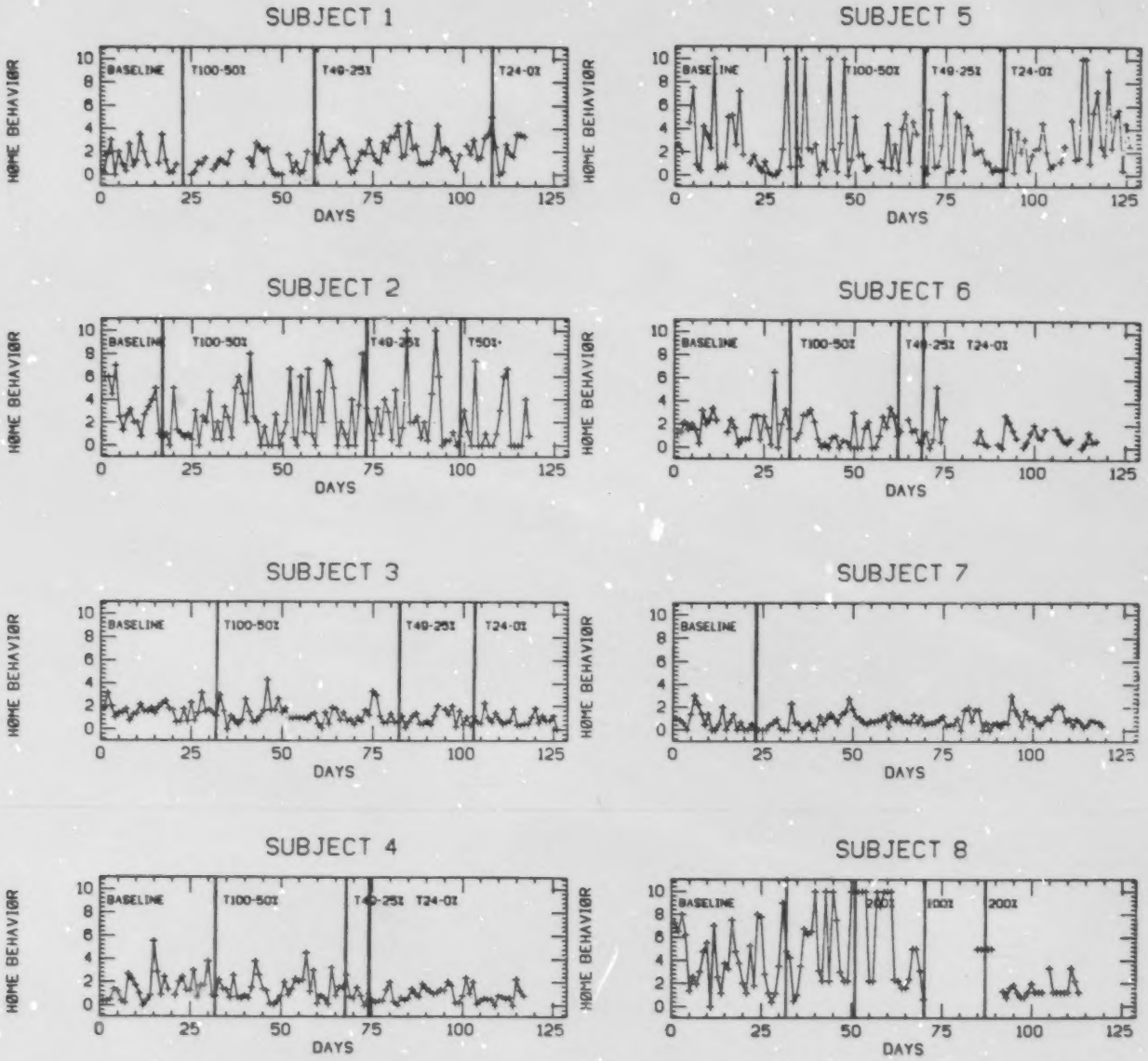

Table 21

Results of Visual Inspection and ARIMA Analyses of Home Behavior Reports

Subjects		Baseline vs. Treatment	Baseline vs. T100-50%	Baseline vs. T49-25%	Baseline vs. T24-0%	Baseline vs. Special Phases
1	Δ Level	NS	NSVI	- $p < .05$ →		
	Δ Slope	NS	NSVI	NS →		
2	Δ Level	NS	NS →		-------	NS[a]
	Δ Slope	NS	- $p < .05$	NS	-------	NS[a]
3	Δ Level	+ $p < .05$	NS →		+ $p < .001$	
	Δ Slope	NS	NSVI →			
4	Δ Level	NS	NSVI	+ $p < .05$ →		
	Δ Slope	+$p < .05$	NSVI	NS →		
5	Δ Level	NS	NS →			
	Δ Slope	NS	NS →		- $p < .05$	
6	Δ Level	+ $p < .05$	NSVI	NS	+ $p < .01$	
	Δ Slope	NS	NSVI	NS →		
7	Δ Level	NS	-------	-------	-------	
	Δ Slope	NS	-------	-------	-------	
8	Δ Level	NS	-------	-------	-------	NS[b] + $p < .05$[c]
	Δ Slope	NS	-------	-------	-------	+ $p < .05$[b] NS[c]

Note. A "+" sign indicates that behavior improved.

A "-" sign indicates that behavior became more hyperactive.

NSVI indicates that changes were nonsignificant by visual inspection.

[a]Days Subject 2 received more than 50% of his original dose.

[b]Days Subject 8 received 200% of his medication for the first time.

[c]Days Subject 8 received 200% of his medication for the second time.

child management. The other subject displayed significantly less hyperactivity at home after his parents had received approximately seven lessons.

The other three treatment subjects did not show clear positive changes in home behavior. Subject 1 became significantly more hyperactive, despite treatment, when his medication was decreased to less than half the original amount (during his T49-25% phase). This negative pattern continued throughout the remainder of treatment. In essence, the home data for Subject 1 looked very similar to his classroom data.

The last two treatment subjects demonstrated no level changes during treatment, but both showed negative drifts in their data at some point in treatment. For Subject 5, this trend toward increasing hypractivity at home occurred after he was withdrawn from more than 75% of his medication (T24-0%). If data collection had continued, his level of negative behavior might have become significantly greater than baseline levels. Subject 2 also showed a negative drift in his Home Behavior Report scores. This drift began early in treatment (T100-50%) but was much more a transitory phenomenon. By the next phase of treatment (T49-25%), this trend toward increasing huperactivity had disappeared. This phase coincided with the parents receiving approximately five of the eight lessons in child management.

Both control subjects showed no significant changes in home behavior over the 14 week treatment. Subject 7, whose classroom behavior proved to be so consistent over the entire course of the study, showed similar stability in his home behavior. Subject 8 showed some variability in his behavior at home when his medication was increased to 200% of his original dose. During the first of these T200% phases, the slope of his data showed a change toward less hyperactivity. During the second T200% phase, this slope change was no longer significant, but the level of his problem behavior at home decreased significantly over baseline scores. The special phase analysis of Subject 2's data did not result in significant changes when his medication was increased (T50% or more).

Comparison of School and Home Data

In summary, Home Behavior Report scores for the treatment subjects in this study showed a different pattern than that of Difference Scores and School Note scores. Instead of deteriorating behavior, half of the treated subjects displayed improved behavior at home. Two of these Subjects, 4 and 6, had shown the most positive results on classroom measures. Neither had become more hyperactive in class during treatment, despite the withdrawal of their medication. The data for Subject 3, however, showed contradictory findings at home and at school. Whereas at school he was one of the subjects least helped by treatment, at home, he was one of the most helped.

A similar discrepancy between results of home and school observations was apparent in the data for Subject 5, but in the opposite direction. At school, his behavior remained unchanged despite medication withdrawal, but at home, the trend in his data was toward significantly increased hyperactivity.

The remaining two treatment subjects showed consistent results across the two environments sampled. Both at home and at school, Subject 1's behavior became increasingly more negative when his medication was cut to less than 50%. Subject 2 showed no changes at home or at school despite his medication reduction to 33%.

For four of the six treatment subjects, results from data gathered at home did not concur exactly with data collected at school. These inconsistencies underline the need to measure hyperactive behavior both in the home and in the classroom. Conclusions based on findings from one environment may not be generalizable to other environments.

Predictors of Treatment Success

A review of Table 4, Subject Characteristics, indicates that neither age, type of medication, daily dosage, medication history, nor IQ predicted a child's response to behavior therapy. Additional subject characteristics, especially those related to school achievement and family variables are summarized in Table 22. A review of this table is only slightly more informative. Subjects 1 and 3,

TABLE 22

ADDITIONAL SUBJECT CHARACTERISTICS

Subject	Reading Achievement	Mathematics Achievement	Adoptive or Natural Parents	Family Environment	Father's Occupation	Mother's Occupation	Use of Child Management Training
1	Superior	Low average	Adoptive	Single parent-Dad No siblings	Health & safety manager	Salesperson	Minimal
2	Inferior	Low average	Natural	Both parents No siblings	Junior college professor	Part-time secretary	Moderate
3	Average	Average	Adoptive	Both parents Younger sister	Policeman	Part-time sales clerk	Optimal
4	Average	Average	Natural	Single parent-Mom Younger sister	Butcher	Bookkeeper	Optimal
5	Very Superior	Average	Natural	Mom & Stepfather Older stepbrother	Dept. Mgr., engineering firm	Nurse	Moderate for 3 mo. Minimal in last month
6	Average	Low average	Natural	Mom & Stepfather Older brother	District sales manager	Homemaker	Moderate
7	Very Superior	Low average	Natural	Both parents No siblings	Automobile mechanic	Part-time hair stylist	-
8	Inferior	Average	Natural	Single parent-Mom Younger brother	Unknown	Secretary/ welfare recipient	-

the boys who were able to be withdrawn from the least amount of medication without problems in school, shared one characteristic: they were both adopted. Subjects 4, 5, and 6, the children for whom treatment was most successful in terms of medication reduction without concomitant behavioral deterioration, had one characteristic in common: they lived with their natural mother, but not with their natural father. These two commonalities are most likely idiosyncratic relationships due to a small sample.

However, one relatonship which has at least more face validity is the positive relationship between parental use of contingency management training and child behavior at home. Those parents who made optimal use of the skills they learned in their child management classes, as measured by their completion of homework assignments and participation in class discussions of assigned reading, seemed to have children who improved in terms of the amount of hyperactivity they displayed at home. This appeared to be the case for Subjects 3, 4, and 6. On the other hand, the parents of Subjects 1 and 5 applied the principles of contingency management minimally, especially during the last phases of treatment, and their sons seemed to respond to medication withdrawal with increased hyperactivity.

Other than these tentative relationships, there were no other known characteristics which predicted response to behavior and drug therapies. This lack of predictors of

treatment success is the rule, rather than the exception in hyperactivity research (cf. Barkley, 1976; Mira & Reece, 1977).

Type of behavior therapy received by the subject, whether combined self-control and child management or child management alone, did not seem to be a factor in the success of therapy. Two of the boys in the combined treatment and both boys in the child management alone treatment showed little or no deterioration of classroom behavior as a result of medication withdrawal. The other two boys in the combined therapy showed significant increases in hyperactive behavior at school when more than half their medication was withdrawn. In terms of observed and rated classroom behavior, adding self-control instruction for children to contingency management training for parents did not increase the effectiveness of the treatment.

The same conclusion can be drawn from review of the Home Behavior Report data. Negative behavior per hour scores improved for exactly half of the boys in each treatment. Whether the child received self-control instruction did not clearly improve the chance that he would respond favorably to medication reduction. Apparently, the most parsimonious treatment, child management classes for parents, was maximally effective.

Pre and Posttreatment Data

Five dependent measures, the Wide Range Achievement

Test (WRAT), the Wechsler Intelligence Scale for Children (WISC), the Matching Familiar Figures Test (MFFT), the Porteus Maze Test, and the Coopersmith Self-Esteem Inventory (SEI) were administered once before and once following treatment. All measures were scored according to standard instructions. Gain scores were computed for each subject on each measure based on his performance at pretesting versus posttesting. Gain scores were subjected to one-way analysis of variance procedures (ANOVA) to determine if there were significant differences between the three groups in this study: self-control instruction plus child management, child management alone, and delayed treatment control.

Over the years, writers have emphasized the unreliability of using gain scores in experimental research because measurement errors become additive (Bereiter, 1963; Lord, 1963). Overall and Woodward (1975) point out that this should not be a concern in studies which use difference scores to measure change induced by treatment. These authors show that the more unreliable the measurement, the greater the probability the null hypothesis will be rejected when it should be rejected. Surprisingly, the power of tests is greatest when the reliability of gain scores is lowest.

Changes in Pre-Posttreatment Dependent Measures

Pre and post scores, difference scores and mean difference scores on the WRAT, WISC, MFFT, Porteus Mazes,

and SEI are presented in Tables 23, 24 and 25. Variability in many of these measures was large, but in all cases, the Bartlett-Box text for homogeneity of variance proved nonsignificant. Analyses of variance indicated significant group differences on one variable, the reading subtest of the WRAT ($F = 6.05$, d.f. = 2/5, $p = .046$). Linear contrasts revealed that the Child Management group made significantly greater progress in reading achievement than the control group ($p = .019$) and the Self-Control plus Child Management group ($p = .008$). None of the other nine variables differentiated between the three groups. There was a tendency for the Self-Control group to show slightly higher Porteus TQ and SEI Total Self-Esteem scores. When the two treatment groups were combined, these trends approached significance for TQ score ($F = 2.99$, d.f. = 1/6, $p = .13$) and Total Self-Esteem ($F = 2.54$, d.f. = 1/6, $p = .16$), with treated subjects improving more than control subjects.

In addition to measures of achievement, cognitive performance, impulsivity, and self-esteem, height and weight were also measured on a pre and posttreatment basis. It was expected that treated subjects would show greater height and weight gains than control subjects because they were undergoing medication withdrawal at the same time as treatment. There was no rationale for expecting differences

TABLE 23

RESULTS OF ACADEMIC AND INTELLIGENCE TESTS

	WRAT Reading			WRAT Math			WISC Coding		
Subject	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
1	127	130	3	87	97	10	42	37	- 5
2	76	85	9	82	67	-15	41	55	14
3	92	91	- 1	104	98	- 6	47	50	3
4	100	105	5	96	105	9	24	25	1
			$\bar{x}$ = 4.0			$\bar{x}$ = - .5			$\bar{x}$ = 3.25
5	192	221	29	104	126	22	20	35	15
	93	109	16	87	74	-13	41	30	-11
			$\bar{x}$ = 22.5			$\bar{x}$ = 4.5			$\bar{x}$ = 2.00
7	164	165	1	88	91	- 3	15	27	12
8	76	88	12	96	84	-12	45	36	- 9
			$\bar{x}$ = 6.5			$\bar{x}$ = 7.5			$\bar{x}$ = 1.50

TABLE 24

RESULTS OF COGNITIVE PERFORMANCE TESTS

Subject	MFFT Errors			MFFT Latency			Porteus TQ			Porteus Q		
	Pre	Post	Δ*	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ*
1	21	10	-11	8.9	24.9	16.00	86	127	41	45	52	7
2	10	12	2	4.12	5.54	1.42	116	133	17	44	38	-6
3	14	17	3	4.92	4.62	- .30	87	101	14	14	1	5
4	17	15	- 2	5.17	9.50	4.33	110	111	1	41	45	4
		$\bar{x}$ = -2.0			$\bar{x}$ = 5.36			$\bar{x}$ = 18.25			$\bar{x}$ = 2.50	
5	19	17	- 2	13.08	14.67	1.59	121	135	14	85	39	-46
6	14	20	6	8.67	10.75	2.08	135	135	0	10	11	1
		$\bar{x}$ = 2.0			$\bar{x}$ = 1.84			$\bar{x}$ = - 7.00			$\bar{x}$ = -22.50	
7	14	14	0	11.62	11.54	- .08	126	129	3	86	66	-20
8	16	15	- 1	6.50	3.62	- 2.88	113	98	-15	37	45	8
		$\bar{x}$ = -.50			$\bar{x}$ = - 1.48			$\bar{x}$ = - 6.00			$\bar{x}$ = -6.00	

Note. * A decrease in MFFT Errors and Porteus Q score indicate positive behavior change.

TABLE 25

RESULTS OF COOPERSMITH SELF-ESTEEM INVENTORY

	SEI Home			SEI School			SEI Total		
Subject	Pre	Post	Δ	Pre	Post	Δ	Pre	Post	Δ
1	10	10	0	10	4	-6	58	62	4
2	14	12	-2	14	16	2	84	78	- 6
3	10	8	-2	10	6	-4	60	54	- 6
4	8	10	2	10	10	0	76	86	10
		$\bar{x}$ = - .5			$\bar{x}$ = 2.0			$\bar{x}$ = .5	
5	8	6	-2	12	8	-4	62	46	-16
6	10	14	4	6	6	0	66	72	6
		$\bar{x}$ = 1.0			$\bar{x}$ = 2.0			$\bar{x}$ = - 5.0	
7	14	14	0	14	16	2	84	86	2
8	10	8	-2	12	4	-8	78	28	-50
		$\bar{x}$ = -1.0			$\bar{x}$ =-3.0			$\bar{x}$ = -24.0	

between either of the two treatment groups, however, since medication withdrawal proceeded at the same rate for subjects in both groups. Therefore, analysis of variance procedures were performed to determine whether there were significant differences between two groups only: the treated group (N = 6) and the delayed treatment control group (N = 2).

Pre and post scores, difference scores and mean difference scores on height and weight are presented in Table 26. Again, variability was large, but the Bartlett-Box tests for homogeneity of variance were nonsignificant. One-way analyses of variance indicated significant group differences on the weight variable (F = 13 60, d.f. = 1/6, p = .008). and differences that closely approached significance on the height variable (F = 3.87, d.f. = 1/6, p = .052). As is clear from the table, subjects in the treated groups did not grow more than subjects in the control group, but rather, lost less than did controls.

Summary of Results

A summary of the time-series and pre-posttest results for each of the subjects is presented in Table 27. Although the information in this table is simplified, it provides a general overview of each child's progress during treatment. The first portion of the table reports the medication levels during treatment and medication withdrawal at which the subject's level of hyperactivity became significantly

TABLE 26

RESULTS OF PHYSICAL GROWTH MEASURES

	Weight			Height		
Subject	Pre	Post	Δ	Pre	Post	Δ
1	23	22	-1	20	25	5
2	75	78	3	97	99	2
3	5	5	0	5	2	- 3
4	88	89	1	90	90	0
5	80	86	6	96	90	- 6
6	78	76	-2	97	94	- 3
			$\bar{x}$ = 1.17			$\bar{x}$ = -.83
7	88	80	-8	90	75	-15
8	87	80	-7	91	86	- 5
			$\bar{x}$ = -7.50			$\bar{x}$ = -10.00

TABLE 27

SUMMARY OF RESULTS

Subject	Observations	School Notes	Home Behavior Reports	WRAT Reading	WRAT Math	WISC Coding	MFFT Errors	MFFT Latency	Porteus TQ	Porteus Q	Coopersmith SEI Home	Coopersmith SEI School	Coopersmith SEI Total	Growth Height	Growth Weight	TOTALS Unchanged or Improved	TOTALS Worsened
1	Meds to 50%	Meds to 100%	Meds to 50%	+	+	-	+	+	+	-	0	-	+	+	-	8	4
2	Meds to 33%	Meds to 33%	Meds to 33%	+	-	+	-	+	+	+	-	+	-	+	+	8	4
3	Meds to 50%	Meds to 25%	Meds to 0%	-	-	+	-	-	+	-	-	-	-	-	0	3	9
4	Meds to 0%	Meds to 0%	Meds to 0%	+	+	+	+	+	+	-	+	0	+	0	+	11	1
5	Meds to 0%	Meds to 0%	Meds to 0%	+	+	+	+	+	+	+	-	-	-	-	+	8	4
6	Meds to 25%	Meds to 0%	Meds to 0%	+	-	-	-	+	0	-	+	0	+	-	-	6	6
7	Meds to 100%	Meds @ 100%	Meds @ 100%	+	-	+	[illegible]	[illegible]	+	+	0	+	+	-	-	8	4
8	Meds @ 100-200%	Meds @ 100-200%	Meds @ 100-200%	+	-	-	+	-	-	-	-	-	-	-	-	2	10

Note. A + sign indicates that performance improved from pre to posttesting.
A - sign indicates that performance worsened from pre to posttesting.
A 0 sign indicates that performance did not change from pre to posttesting.

Medication levels reported are those that the subject was withdrawn to without significant increase in the level of his hyperactive behavior.

greater than that of baseline. Slope changes are not reported. The middle portion of Table 27 indicates for each of the 12 pre and posttreatment measures, whether the child's performance improved, remained the same, or deteriorated following the intervention. The third portion of the table is a simple tally of the information in the middle portion. It summarizes the number of areas in which the subject remained at his pretest level or improved versus the number of areas in which his performance declined. These totals are a nonstatistical measure of growth and are intended to provide only a gross indication of overall response to treatment.

In addition to the Summary of Results table, case studies of four of the subjects in this research project are presented to provide descriptive information on response to treatment. Three treated subjects and one control were selected for case study presentation because each displayed a different or unexpected response during the intervention. As a group, they serve to illustrate the variability in the hyperactive child's medication history and family situation as well as their varied response to behavior therapy and stimulant medication withdrawal. In order to maintain confidentiality, the names of the boys have been changed.

Subject 1 (Treatment)

Adam was a ten year old boy in fourth grade who demonstrated superior academic achievement in reading and

low-average performance in math. He was an unusually small boy, scoring in the low 20th percentiles for his age in height and weight. Adam expressed concern over his size, saying that it was the reason he never participated in sports.

Adam had a long medication history, receiving his first dose of amphetamines from his parents at one year of age. Within the first months of each new school year, his teacher reported Adam's activity level to be abnormal and the parents responded by increasing his medication dosage. By the time he entered fourth grade, the boy was taking between 80 and 100 milligrams of methylphenidate per day.

Adam had a rather unusual family situation. He was adopted at one year and lived with his parents and older adopted sister until middle childhood. It was then that his parents divorced, citing Adam as one of the main reascns for the dissolution of their marriage. The mother expressed great animosity toward the boy, so the father, a professional man in his early fifties, accepted responsibility for raising him.

Adam's father entered this research study desperate for some assistance in managing his son. When told that Adam's daily dose of medication was so high that he appeared substantially different from the other potential subjects, the father gradually decreased the dose until the boy's medication level was commensurate with standard doses for

boys his size and age. He reported no obvious behavioral deterioration following this medication reduction.

The father had numerous complaints about Adam's behavior. The boy wet his bed almost nightly, was late for school almost daily, never completed any homework, and frequently talked back or argued when asked to do something. Adam's disruptive behavior had curtailed most all father-son activities and had severely cramped the father's personal life. The man had become extremely negative about his son and used punishment on a frequent basis.

During treatment, Adam's father learned to use rewards to increase positive behaviors such as getting to school on time, and he employed time-out for severe problem behaviors. When he used meaningful rewards, such as extra television time, Adam responded by improving his behavior. But often the father got too busy and discontinued reinforcing the boy after a short time. Adam responded by returning to his previous maladaptive behavior.

During treatment, Adam's behavior in school showed no significant changes until medication was reduced to less than 50% of his original dose. At home, his father's daily frequency counts corroborated this finding. Here, too, there was a significant increase in hyperactivity when medication was halved. However, it should be pointed out that on all three intensive measures Adam's baselines were high. When fully medicated, he acted better than most of

his peers and was rated very positively by his teacher. His home behavior was better than most of the other subjects in the study. Evidently, Adam's good baseline behavior was a difficult standard to maintain during treatment.

In terms of other measures, Adam showed great progress after treatment, despite complete withdrawal of his medication. Table 27 summarized his direction of change on the variety of variables assessed in the study. Following treatment, he remained at his same level or improved his performance in eight of twelve areas. This is comparable to, if not better than the two control subjects who remained on full medication throughout the study. Surprisingly, Adam showed greatest gains in the academic and cognitive areas, despite the fact that he was significantly more off-task, out-of-seat, noisy, etc. during the last phase of treatment. Perhaps for Adam, disruptive classroom behavior was not inconsistent with learning.

Adam is an interesting case because of his unusual family and medication histories and his uneven pattern of response to treatment and medication withdrawal. For him, changes in behavioral measures at home and school did not predict the direction of change in performance measures.

Subject 3 (Treatment)

Brian was a seven year old boy in the second grade who demonstrated average achievement in reading and math. Without his medication, he was highly distractable, spending

only brief amounts of time at his desk doing his school work. More often, he was out of his seat, talking to anyone who would listen, making disruptive noises, or just wandering around the classroom.

Since Brian was three years old, his parents had recognized that he was a problem child. He was adopted amd never seemed to act like their own natural child. But when he began school, his kindergarten teacher had no trouble controling him so his parents tended to blame themselves for his misbehavior. They thought perhaps they were too permissive with him and began punishing him more frequently with paddlings on his rear. Despite the new approach to discipline, Brian continued to be unmanageable. During the first few weeks of first grade, the problems his parents had seen at home manifested themselves at school. Brian was impulsive, inattentive, and argumentative. His pediatrician diagnosed him as hyperactive and prescribed methylphenidate. Brian's father, a police officer, objected to the use of drugs to control his son's behavior. But he and his wife had tried the Feingold diet and various forms of counseling for themselves and their boy. These efforts had clearly not proven successful in the past. Sensing no other alternatives, and wishing to eliminate the serious marital discord this child caused, the father acquiesed to drug therapy. Since six years of age, Brian had taken stimulants daily to control his hyperactivity at home and at school.

Brian's parents were eager to be included in this study, stating in their application that they greatly respected this research effort. During treatment, they were extremely cooperative and made every effort to learn and apply the principles they were taught. They learned how to reward their son for a variety of positive behaviors, including getting to school on time, picking up his belongings, eating dinner with the family rather than at 11:00 pm, and telling the truth. Brian's parents were most successful at using time-out for the numerous destructive acts he was guilty of, including hitting his mother and sister and destroying the house. The frequency of these behaviors sharply decreased when the parents changed the way they responded and the mother found she no longer had to resort to the paddle. Brian's parents began to feel more in control of their son at home and realized a new-found respect for themselves as parents. On their post project evaluation, the mother wrote that the program had been the "answer to her prayer"; that before, she had been "drowning in her own guilt and mistakes".

When Brian's behavior at school began to deteriorate, his parents attributed this decline to his teacher's reinforcement of negative behavior, rather than to the reduction of his medication. The mother talked to the teacher about ignoring inappropriate behavior and using time-out for severe problems. Much to her chagrin, the

teacher, more than eight months pregnant, did not implement her suggestions.

During treatment, Brian's behavior in school showed no significant changes until medication was reduced to less than 50% of his original dose. At this point, his behavior showed a sudden and profound decline. The data were clearer in Brian's case than that of any of the other subjects: he needed between .17 and .33 milligrams per kilogram of methylphenidate two times per day in addition to behavior therapy if he were to behave like others in his class.

Consistent with Brian's increase in disruptive classroom behavior was a decline in the amount he appeared to be learning in school. On the majority of dependent measures, Brian actually showed worse performance at posttesting than he had at pretesting. Most of his academic achievement, cognitive functioning, and self-esteem scores decreased following intervention. The only area in which he showed a positive trend was physical growth. Although height and weight are important considerations for this extremely small boy, his overwhelmingly negative performance in all other areas argue against his complete withdrawal from stimulant medication.

Interestingly, Brian's parents observed an opposite response to treatment and medication withdrawal than was recorded at school. Instead of Brian becoming more hyperactive over the duration of treatment, at home, he

became significantly less hyperactive than before treatment. This contradictory finding could be attributed to the wishful expectations of the parents. But the fact that the daily frequency count they took was a relatively objective measure, discounts this explanation somewhat. Another possible explanation for Brian's positive change at home is the parent's consistent use of reinforcement and punishment.

Brian was selected for complete description because his results are very clear. At home, he substantially improved as treatment and medication withdrawal progressed. His school data are equally conclusive, but in the opposite direction. His classroom behavior significantly deteriorated as a result of treatment and drug reduction. This child is a puzzling case. It is unclear whether Brian needs stimulants to control his hyperactivity or whether a consistent management approach at school like the one used by the parents at home would bring his behavior under control.

Subject 4 (Treatment)

Chuck was an eight year old boy, who, having failed a grade in school, was a second-grader at the time of this study. His achievement in reading and math was average for his grade. Chuck was a large, strong boy who was a leader in most all sports. His hobby was motorcross bicycle racing, which he frequently did on weekends.

Chuck came from a split home, living with his mother and younger sister in what appeared to be a relatively amicable parental separation. He saw his father often, both during the week and on weekends, and showed great feeling for both his parents.

The mother recognized that Chuck was hyperactive when he was two years old. He was more active than other children, walked sooner, and got into everything. When he entered school, it became even more clear that Chuck was a problem child. In one day he was reported to have thrown a chair at a boy, put crayon shavings in a girl's hair, spit on a child, and pounded on the windows when he was excluded from his class. At the time of the study, the parents' chief complaints were Chuck's bullying, argumentativeness, swearing, bedwetting and overt defiance. The mother, especially, was concerned because as Chuck got older and stronger, she had more and more trouble getting him to do what she wanted. They feared that Chuck could become a juvenile delinquent if he continued on his present course.

Despite their separation, both parents chose to participate in the behavioral treatment. They each attended all sessions of the child management class, although the mother was the major implementer of behavior change projects. Both parents were positive about the new approach to child management and tried the various strategies suggested to them. The mother was unusually adept at

developing and following through with contracts and token economies. In the spring, Chuck earned his entire baseball uniform, week by week and cleat by cleat, by completing household chores, reading in his free time, and doing what he was asked without arguing. The parents found the use of time-out almost unnecessary because of their success with contingent rewards. Instead of playing his previous role of "smart-mouthed tough guy", Chuck began to be a much more amiable child. He started cooperating in his self-control lessons and seemed to enjoy the games and activities he was asked to participate in during these sessions.

Chuck is included as a case study because he showed the most consistent, positive results of all the treated children. He was gradually withdrawn from all stimulant medication without demonstrating any increase in negative behavior at home or at school. In fact, Chuck's home behavior showed a significant improvement in the final phase of treatment. His observed behavior at school showed a significant trend toward improvement during this same period, making it likely that had data collection continued, his level of negative behavior might also have dropped significantly in the classroom.

In addition to improved observable behavior, Chuck's performance on the academic, cognitive and self-esteem measures also resulted in large gains. Overall, his was the most positive showing on pre and posttreatment measures of

all the subjects in the study, including the controls. On eleven of twelve measures, his scores improved over pretest scores or remained the same. In all respects, Chuck proved to be the "success story" of this research project.

Subject 8 (Control)

Donny was a seven year old boy in the second grade who had made average to poor academic progress in school. He was an extreme behavior problem in class, even while on stimulant medication, and was sent home frequently by his teacher throughout the study. Suspensions were generally because he hurt another child.

Donny's family life was not ideal. He and his three year old brother lived alone with their mother in a low income apartment complex. On at least two occasions during this study, the building was condemned by the local health department for its unsanitary conditions. The family seldom heard from Donny's father who lived in New York.

Donny's mother was working as a secretary when he was selected as a subject for the study. However, she quit her job midway throught the research when Donny became so unmanageable that she felt she needed to be with him at all times. She then applied for aid from the State and remained a welfare recipient until the conclusion of the study.

Donny had always been difficult for his mother to manage. She stated that she was surprised he had survived past three years, what with all the accidents he had during

his toddlerhood. The mother's complaints at the time they entered the study were that Donny hit his brother, cried, whined and complained often, wet his bed every night, never finished any task, and frequently hid his glasses because he thought they made him look ugly.

Several weeks into the study, Donny's aggressive actions caused his mother great alarm. The precipitating event occurred one Saturday night while she was out and the boys were left with a babysitter. Donny took a saw to the back of his younger brother's neck and caused an open wound. He also used the saw to cut a large hole in the couch. The following Monday the mother took the boy to his pediatrician, who increased Donny's medication to 150% of his previous dose. He also referred Donny to a child psychiatrist who began to see the boy on a weekly basis. Treatment consisted of play therapy and analytic discussions about his mother and father.

Despite his increased medication and psychiatric treatment, Donny's behavior continued to be out-of-control. At school his negative behavior was maintained at previous high levels and he continued to be sent home before school was out. At home he was as much a problem as ever. The mother and pediatrician decided to increase his medication to 200% of his original dose and to continue with the psychiatric visits.

There was no appreciable change following this second increase in medication. Donny's behavior reached the nadir one night when his mother spent the evening with a friend. He rubbed raw eggs into the living room furniture, called the people on his mother's phone list and told them she had left him, and began talking about joining his favorite Aunt in Heaven. His mother was distraught at what she interpreted to be his suicidal thoughts and his generally worsened behavior. She decreased the boy's dosage of medication to the original amount. After about two weeks of no substantial behavioral changes, she again increased the dose to 200%. Donny remained on the higher dose until the end of the study. He also continued to see the psychiatrist on a weekly basis.

Donny's mother's experimentation with drug dosages did not appear to have any significant effect on her son's behavior. Naive observers in the classroom saw no changes in the amount of negative behavior he displayed. Whether he was on 100%, 150%, or 200%, he always had large, positive Difference Scores, indicating that his behavior continued to be much worse than the other boys in his class. Of his nine worst weeks, four were when he was on 37.5 mg. of pemoline, four were when he was on 75 mg., and one was when he was on 56.25 mg.

Donny's teacher saw a change for the better during the second T200% phase, as indicated by her School Note ratings.

The mother, too, reported his behavior as improved during the second T200% phase. However, there is much missing School Note and Home Behavior Report data during this period, casting some doubt on the validity of these results. The classroom observational data are complete for all phases.

Donny is an interesting case study. Although he was a control subject, his behavior during this study proved to be anything but stable. Over time he seemed to get worse, despite the increase in medication and advent of psychiatric help. In addition, his academics, his cognitive functioning, his self-esteem and physical growth were all retarded during the seventeen weeks he was in this study. Perhaps he illustrates what can happen to a family when the parent has no child management skills and must rely on stimulant medication to control the hyperactive child.

Chapter Four

DISCUSSION

Research Implications

The objective of this research was to determine if two behavioral treatments involving instruction for parents in child management and in some cases, supplemental instruction for children in self-control skills were as effective as drug therapy in the treatment of childhood hyperactivity. Results indicated that response to treatment was highly individualized. For some subjects, behavior therapy allowed the full withdrawal of stimulant medication. For other children, behavioral treatments were only partially successful at replacing stimulant medications. Two research questions emerged from this study. First, why was self-control instruction ineffective when combined with the child management program for parents? Second, what is the minimal treatment necessary to replace drug therapy for the hyperactive child?

The Effectiveness of Self-Control Instruction

The self-control instruction in this study did not enhance the effectiveness of the standard behavioral treatment for hyperactive children. Surprisingly, subjects who received forty-eight lessons in how to control their hyperactivity showed no greater improvement at home or at

school than treated subjects who received no such instruction. It appears that parental training in child management was the influential component in the combined treatment. The self-control curriculum used in this study seemed to have little effect on hyperactivity.

Recently, other researchers have found the results of self-control training with hyperactive children to be disappointing (Pelham, Ronnei, Paluchowski, Marks, Schnedler, Miller, Budrow, Nilsson, & Bender, in press; Kendall & Wilcox, 1980). Pelham (in press) tested a training program in positive social interaction and self-evaluation using instruction, modeling and practice. The program was very similar to the one used in this investigation (See the social problem-solving component of the Self-Control for Kids Curriculum, Note 5). The Pelham group found that the eleven hyperactive children who received social skills training did no better on parent and teacher ratings, peer nomination inventories, and acheivement tests than children who did not receive the training.

Kendall & Wilson (1980) also found self-control to be minimally effective in their study of elementary aged hyperactive children. They provided 22 children with self-instructional training much like that offered to the boys in this study (See the self-direction component of the Self-Control for Kids Curriculum, Note 5). Such training

cued their sons to use the newly learned skills. Teachers were minimally involved in the reinforcement program and thus, only occasionally rewarded self-control behaviors.

To make matters worse, the use of self-control sometimes produced negative natural consequences for the children in this study. For example, several of the boys tried using relaxation when they became angry or anxious on the playground or in class. Their peers, not realizing what the boys were doing, made fun of this unusual display of muscle tensing and relaxing. As expected, relaxation was quickly extinguished.

Rosenbaum and Drabman (1980) highlight another essential element in self-control training which was probably not sufficiently addressed in this study: generalization. All three types, time generalization, response generalization and setting generalization, were considered in the Self-Control for Kids Curriculum, but in retrospect, only perfunctorily. Boys were told when they learned a new skill that it could be used in a variety of settings or that it might be usefully applied to a range of tasks, both now and in the future. Sometimes the children themselves brainstormed when or where they would use the new skill. But again, external agents did not routinely ensure that the child actually followed through and they did not consistently reinforce him for doing so. It was mistakenly assumed that because self-control training could change

had no significant effect on several dependent measures, including the Matching Familiar Figures Test and the Porteus Maze Test. The attention-placebo control group performed as well on these measures as did the groups who were taught how to self-instruct.

Reviews of self-control procedures with children point out possible reasons why the curriculum used in this research might not have been effective (O'Leary & Dubey, 1979; Rosenbaum & Drabman, 1979). O'Leary and Dubey repeatedly stress the importance of external persons and events to reinforce the use of self-control. Children should not only be told to use their self-control skills; they must be systematically rewarded for doing so. Apparently, external rewards must be gradually faded over a period of time until the child experiences self-reinforcement for demonstrating appropriate behavior.

Inadequate external reinforcement was probably the main failing of the Self-Control for Kids Curriculum. Treatment subjects learned a variety of self-control skills and were consistently reinforced for practicing them <u>during their lessons</u>. In addition, parents and teachers were asked to reward the boys whenever they saw any of the skills being performed. Despite these efforts, external reinforcement was generally weak, nonsystematic, and infrequent. Parents usually employed praise rather than more primary reinforcers like those used during the lessons themselves. They seldom

behavior in the therapeutic session, that it would have the same effect at other times, in other environments, and with other external influences present.

The shortcomings of the self-control program as described above could be remedied by implementing the following revisions:

1. Involve parents as instructors in the self-control lessons to promote their role as reinforcers. This approach was tested with the parents of the delayed treatment control children and proved to be a workable solution.

2. Involve teachers in the self-control program by having them teach appropriate lessons to their classes as a whole. Doing so might increase teacher reinforcement of self-control skills and reduce peer teasing when self-control skills were demonstrated. Lessons which lend themselves to class instruction are those teaching how to relax, how to keep your hands to yourself, how to use self-verbalization to guide your actions and what to do when you have to wait.

3. Set up a communication system between home and school to inform parents when their child has successfully displayed self-control at school. An item or items could be added to the present School

Note to serve this purpose. Then parents could consistently reinforce their hyperactive child for displaying the self-control skills he learned.

Perhaps with these revisions, a comprehensive self-control program for hyperactive children like the one evaluated in this study could be more effective than either parental child manaagement training or treatment with stimulant medication. This conjective remains for future research.

The Minimal Treatment for Childhood Hyperactivity

Teaching parents the principles of contingency management proved to be a maximally effective behavioral treatment for hyperactive children. With this treatment, two children were completely withdrawn from medication and four were partially withdrawn without adverse effects on their classroom behavior. Three children were completely withdrawn and three were partially withdrawn without adverse effects on their home behavior. However, the causal relationship between behavioral treatment and behavior change is tentative. It is possible that treated subjects could have been withdrawn from medication without any behavioral treatment. Perhaps gradual medication reduction, not parent training, was the element of treatment which produced the observed results. Unfortunately, the design of the present study prevents clarification of this possibility.

Results from the double blind placebo trials conducted during screening, however, argue against this hypothesis. During placebo trials, all subjects showed marked deterioration in their behavior on the days when they took placebo medication as compared to the days when they took active medication. If they "needed" stimulants to control themselves during screening, it is improbable that in a matter of weeks they no longer required these drugs. Changes in the way their parents responded to them most likely accounted for changes in their medication needs.

Despite the arguments in favor of behavior therapy being the essential element in treatment, future research might focus on gathering more conclusive evidence of the merits of a behavioral approach. A later study might use a control group which is gradually withdrawn from stimulant medication with minimal supportive contact from the experimenter. The parents of the subjects in this group would receive neither formal nor informal training in child management. They would simply be reassured and encouraged to continue medication withdrawal, perhaps in weekly telephone calls from a project staff member. Another treatment group would be gradually withdrawn from their medications also but, in addition, their parents would receive a course in child management like the one used in the present study. In this way, the two groups would differ in treatment, not in drug withdrawal regimens.

If results from such an experiment showed that both groups could be withdrawn equally from medication, then behavior therapy would appear to be an unnecessary treatment. If, however, behaviorally treated subjects showed greater success in medication withdrawal, results of the present study would be supported. That is, parental training in child management would appear to be the minimal treatment necessary to produce maximal benefit for hyperactive children.

Treatment Implications

The Place of Behavioral Treatment in Childhood Hyperactivity

For three of the treated subjects in this study, behavior therapy reduced or eliminated the need for stimulant medication to control their hyperactive behavior. These children were withdrawn from their stimulant medications with few or no adverse effects on their behavior, academic performance, cognitive functioning, self-esteem or physical growth. In fact, in many areas, these boys actually showed positive effects from the intervention.

Why had these boys been treated with medication and risked its attendant side effects, when their behavior could have been improved with parental child management training? Probably the most obvious reason for the choice is that physicians are well-trained in the use of drugs to treat medical problems but less familiar with nonpharmacological

treatments. For this reason, physicians look for other solutions to childhood hyperactivity only after standard drug therapy proves ineffective. As a result, behavior therapy is often prescribed secondarily or in addition to standard drug treatment, making it commonly referred to as the "adjunctive treatment."

The findings of the present investigation suggest that perhaps the order of therapies for hyperactivity should be reversed; namely, that a behavioral treatment should be prescribed first and medication considered secondarily. Only if parent and teacher training fails to result in significant behavioral changes, should medication be considered as the next treatment option. A recommended plan for the physician who chooses this "reverse" treatment strategy shall be presented later in this chapter.

Costs of Behavioral and Drug Treatments

If behavior therapy is to be chosen as the initial approach to the treatment of hyperactivity, the issue of cost must be considered. Although it is commonly believed that many hours of expensive psychological consultation are necessary to treat the hyperactive child, little data are available to support this assumption. Despite O'Leary's (1980) recent call for long term studies to explore relative costs of and consumer satisfaction with various treatments as yet, there have been few research studies which address the cost effectivneess issue (c.f. Siegert & Yates, Note 6).

There is also a complete lack of research to substantiate the claim that drug therapy is the least expensive treatment. Perhaps it will not be long before we begin to see cost-effectiveness figures reported as a matter of course in comparative treatment studies.

Availability of Behavior Therapy

If behavior therapy is to be a primary treatment for hyperactivity, it is essential that it be readily available. It is assumed that this availability relies on highly paid psychological-educational professionals skilled enough to offer such a behavioral treatment. Surprisingly, however, this research showed that the most effective treatment is a relatively standard contingency management course for parents. Classes such as these are sometimes offered by elementary school districts or county offices of education, by community colleges, by university extension services, and by public and private mental health clinics. In some school districts, a few regular classroom teachers are skilled enough at managing behavior problem children so that they are capable of conducting such a course for parents. Courses are effectively taught by trained and experienced special education teachers or administrators, by elementary school psychologists, by marriage and family counselors, or by social workers. Highly paid, doctoral level instructors may not be necessary to teach such classes. Thus, the pediatrician has at his or her disposal the possibility of an accessible referral for behavior therapy.

In summary, behavior therapy appears as a logical primary approach to the treatment of childhood hyperactivity. It avoids the potentially harmful effects of medication, it is increasingly available within existing community resources, and at this time there is no evidence that it is more costly than traditional pharmacological management.

An Individualized Treatment Approach

The results of this study are as complex and varied as the eight boys who were its subjects. No two boys showed the same pattern of response to medication withdrawal and behavioral treatment. Each responded in a highly individualized manner. Some of the treated subjects improved at home, whereas others got worse. Some boys displayed more hyperactive behavior at school as treatment progressed, while others did not. Some made gains in their academic, cognitive, and physical growth over the course of the study, while others regressed in these areas. No two boys responded alike. In fact, no boy showed even a consistent direction of change on all measures. Even the two non-treated subjects who remained on medication throughout the entire study differed in their mental, physical and behavioral responses to stimulants.

Other researchers have found inconsistent patterns of response to treatment among their hyperactive subjects (O'Leary & Pelham, 1976). In a most recent study (Pelham,

Schnedler, Bologna, & Contreras, 1980), it was reported that four of eight subjects displayed levels of on task behavior comparable to nonhyperactive controls when they were given high doses of methylphenidate (.75 mg/kg). Two other children reached a normal level of on task behavior when given low doses of the drug (.25 mg/kg), one without any medication at all, and the last child never reached comparable levels of on task behavior. If these results are grouped, the high dose of medication appears to be the treatment of choice for hyperactive children. Yet this dosage would not be the maximally effective one for <u>half</u> of the subjects.

In short, what works for one hyperactive child may not work for another. Combinations of treatments, such as behavior therapy and psychostimulant medication may be the maximally effective treatment for some hyperactive children. Perhaps researchers should discontinue conducting group experiments which pit one treatment approach against another. Except to test new treatments, such as self-control instruction or social skills training for the child, such experiments are no longer particularly informative. We already know that medication and behavior management training are successful therapies for some children. What we don't know is how to predict which therapy or combination of therapies will be most effective for a given hyperactive child.

So what does this say to the clinician faced with treating a hyperactive child who walks into his or her office? A useful caveat might be: a simplistic approach to treatment is probably not the most effective. The child needs to be viewed as a complex individual. His present level of academic functioning, his current height and weight, his behavior at home and at school must all be considered in making a decision regarding treatment.

For example, as a result of this study it was learned that Subject #3 functioned well at school on 50% of his original medication, and better at home on no medication. His academics and cognitive functioning showed sharp decreases over the period that his medication was withdrawn to 0. Whether to continue this child on stimulants is not a simple decision, considering the variable effects medication had on him. Every clinician and parent must ask what treatment is best for all aspects of the child's well-being. Mental, physical and behavioral growth must be considered. In the end, the treatment or combination of treatments chosen will most likely be the result of a tradeoff. Giving a child any amount of medication has some negative effects. The tradeoff comes when the negatives are balanced against the positives that medication is likely to achieve. Conversely, allowing a child to continue acting in a hyperactive manner by not prescribing stimulant medication also has some adverse effects. Here, too, the positives must outweigh the negatives.

An individualistic approach to deciding on the appropriate treatment for a hyperactive child is not always used. Resesarchers are partly to blame for this state of clinical affairs. There are thousands of studies which report data about hyperactive children, but few elaborate on the implications these data have for clinical practice. The practitioner has not been given adequate guidelines to follow in prescribing the optimal treatment for a given hyperactive child. Based on the results of this investigation, the following procedures were developed to assist the physician who wants to prescribe the most individually effective treatment for his hyperactive patient.

Proposed Medical Management of Childhood Hyperactivity

There are four basic principles which underlie the following recommended management of the hyperactive child: 1) no child should be administered stimulant or other medications until there is clear evidence that his hyperactive behavior cannot be brought under control using a nonpharmacological treatment; 2) no child should be administered medication for hyperactivity without careful consideration by the parents and physician of the effects of drug therapy on the physical, mental and behavioral well-being of the child, coupled with weighing the relative merits of each; 3) any child who is administered stimulants to control his behavior should receive the minimal dose

needed to produce positive behavioral changes; and 4) no child, no matter how severe his hyperactivity, should be given more than approximately .4 mg/kg of methylphenidate at each administration or more than 37.5 mg/day of pemoline.

The recommended approach has been simplified as much as possible for the private physician with a full practice. Measures which are already available to the physician, such as those obtained in a routine physical examination or in annual school achievement testing are used whenever possible. Additionally, some new measures must be developed in consultation with the child's parents in order to evaluate the most effective treatment for the individual patient. Fortunately, these are not complex or difficult to develop and can be based in large part on the dependent measures used in this research.

Before any therapy is prescribed and evaluated, it is assumed that the physician has taken a thorough developmental history, done a complete physical examination, and obtained pertinent laboratory data to discover any organic causes for the child's hyperactivity. Once allergy, seizure disorder, tumor, degenerative brain disease, psychiatric dysfunction, and confirmed brain injury have been ruled out, treatment procedures can begin.

Collecting baseline information. Three types of measures are suggested to evaluate the effectiveness of therapy for a hyperactive child: physiological, behavioral

and academic. The physiological measures, height, weight, pulse and blood pressure can all be obtained in the physical exam and should be recorded on an ongoing progress report. Academic measures include reading, math and other achievement scores obtained from the child's school records. Behavioral measures include a daily rating from the child's teacher at school (School Note) and a daily report from his parents at home (Home Behavior Report). In order to be meaningful, these measures should be individualized for the particular problems of the child. In consultation with the physician, five specific items on both the School Note and Home Behavior Report should be selected by the child's teacher and parent. Lists of items appropriate for hyperactive children appear in Appendix B and samples of the School Note and Home Behavior Reports used in this study appear in Appendix G.

Once the School Note and Home Behavior Report are developed, the parent and teacher complete them daily for two weeks. At the end of the two week period these forms are returned to the physician. An average score is calculated for the child's performance at school and home. These are baseline scores; they provide a measure of the child's behavior prior to treatment. As an example, a child who has a high average score at school (e.g., greater than 17) and a low average score at home (e.g., less than 1.00 negative behavior per hour) appears to be functioning well

without any treatment as these levels are comparable to those achieved by the subjects in this study when they were on full medication. A child who receives worse scores on either or both of these measures might well show significant behavioral improvement from treatment.

Primary treatment: behavior therapy. Some children do not need stimulant medication to control their hyperactive behavior. These children are not necessarily any less hyperactive. It is simply that their behavior can be brought under control by changing the responses of their parents and others in their environment. The task of the clinician is to differentiate this subgroup of hyperactive children from those who will eventually require drug therapy. In order to do this, it is recommended that behavior therapy be the first treatment prescribed by the physician.

Following the gathering of baseline information, the physician should refer the parents of hyperactive patients to a professional who will provide instruction in child management. As discussed earlier, there are a wide variety of people able to teach such skills. Content of the course should include lessons in three major areas:

1. how to observe and record the behavior of the hyperactive child accurately:

2. how to increase desirable behaviors in a systematic fashion through rewards, social praise, contracting and token economies;

3. how to decrease undesirable behaviors through the consistent use of time out from positive reinforcement.

An important point to stress about behavior management training is that parents not only need to learn new skills to control their hyperactive child, but that they need to practice these skills. If a change in knowledge does not result in a change in behavior, then parent training will have little effect. This research project used financial incentives (the eight pre-written checks) to motivate parents to practice new techniques for rewarding and punishing their children. It is important that physicians in private practice explore similar incentives with parents. The physician can be an important motivator by emphasizing to parents the need to apply what they learn consistently and by inquiring during follow-up visits about new management strategies that seem to work with the child.

Throughout the period of class instruction, the teacher and parents should be completing School Notes and Home Behavior Reports on a daily basis. These should be sent to the physician every two weeks for calculation of average scores at school and at home. These average scores along

with those obtained during baseline are recorded on an ongoing chart to allow review of the child's behavioral progress over time.

Evaluation of behavior therapy. After the parents complete their behavior management classes, all physiological, academic and behavioral data should be compiled for review with the parents. The child's average scores on School Notes and Home Behavior Reports before behavior therapy (baseline scores) are compared to the scores he obtained after the behavioral treatment. A ten to twenty percent increase in School Note Scores or a ten to twenty percent decrease in Home Behavior Report Scores would indicate substantial improvement. These figures were selected because they are comparable to the improvement shown by subjects in this research study while on active medication during placebo trials.

If substantial improvement occurs as a result of training in child management, parents should be encouraged to continue the behavioral programs they have instituted. Reevaluations need to be scheduled for every two to three months to review the child's progress and evaluate the treatment. If the child's behavior continues to improve, reevaluation periods may be attenuated to every six months. If the child's home and school behavior does not show improvement following class instruction in child management, the physician might want to consider referring the parents for more individual counseling in child management.

If additional help does not result in improved behavior as measured in the School Note and Home Behavior Report, stimulant medication might be necessary. The parent and physician should then review the child's physiological and academic data to determine if drug therapy is in the best interests of the child. For example, an unusually short or thin child might be adversely affected by stimulant medication because of possible growth suppression. This is not so much a concern, however, if the child is above average in height and weight.

A child's academic standing in school must also be considered when the decision is made to prescribe stimulants. A child whose scholastic performance is above average may not be a good candidate for drug therapy. Despite his hyperactive classroom behavior, this child is learning in school. Recent evidence suggests that introduction of stimulant medication can upset the scholastic progress of normally achieving children (Charles, Schain, Zelniker, & Guthrie, 1979). If, however, the hyperactive child is performing below the norm in reading and math, stimulants might improve his ability to resist distractions and to attend to task.

Secondary treatment: stimulant medication. Whether stimulant medication is prescribed for a child should be an individual decision made in consultation with the parents. If, in considering all of the above, stimulant treatment is

agreed upon, the dose of medication should be kept to a minumum. Beginning doses of methylphenidate should be between .1 and .2 milligram per kilogram body weight. There are no clear guidelines for the administration of pemoline in the research literature. Suggested beginning doses based on the results of this study are 9.375 milligrams per day.

Whether the child is begun on one or two daily doses of .1 to .2 mg/kg of methylphenidate is a decision that should be made with some input from the child's teacher. Most elementary classrooms require children to demonstrate maximum levels of on task and in seat behavior during the morning hours. This time is when academic work is usually stressed. If the hyperactive child needs medication, it is given to him before going to school to maximize attention span and ability to resist distraction during the morning periods. Generally, less structured activities are scheduled in the afternoons; the child may not need any stimulants during these hours. If possible, only a morning dose of medication should be prescribed.

Evaluation of drug therapy. Reevaluation should be scheduled for approximately one to two months after beginning stimulant treatment. This time period is generally adequate for stimulant medications to reach their full effectiveness. Methylphenidate takes the least amount of time; pemoline can take as much as three to four weeks to demonstrate significant clinical benefit (Facts and

Comparisons, 1980). School Notes and Home Behavior Reports should be completed for a two week period before reevaluation, and physiological measures should be taken at this time. The physician and parents need to update behavioral, physiological and academic information if they are to evaluate accurately whether stimulant medication has improved the hyperactive child's condition.

If low doses of stimulants do not result in measurable improvement in the child's behavior at home or at school, higher doses might need to be prescribed. It is recommended that each administration of methylphenidate never exceeds .3 or .4 mg/kg and that the total dose of methylphenidate taken per day is no more than .75 mg/kg. Daily doses of pemoline should not exceed 18.75 to 37.5 mg. Maximum doses were based on subjects in this study who were least able to be withdrawn from their medications. Subject 1 needed approximately .36 mg/kg of methylphenidate twice each day in order to perform maximally at home and at school. This was 50% of his original dose. Subject 3 needed approximately .33 mg/kg of methylphenidate twice a day to behave appropriately at school: this was 50% of his original dosage. Subject 6 needed 14.06 mg of pemoline daily to perform maximally at school, about 25% of his original dose. There is other research evidence to suggest that .3 mg/kg of methylphenidate is the optimal dosage if the child's learning and cognitive functioning are to be maximized (Brown & Sleator, 1979; Sprague & Sleator, 1977).

Follow-up. No matter what amount or type of medication the hyperactive child is taking, his case should be reviewed frequently during the year. As in earlier evaluations, parents and teachers will need to complete Home Behavior Reports and School Notes for the two week period preceeding each follow-up. These data are then used to determine if drug therapy is effective and to decide if it should be continued.

Drug therapy which was at one point deemed necessary may not be required at a future date. For example, changes in classroom teachers from year to year can have a significant effect on the child's behavior in school. Most subjects in this study had at least one teacher who expressed having little trouble managing the boy and therefore did not perceive him as hyperactive. In a similar fashion, changes in family circumstances can increase or decrease hyperactive behavior. If environmental changes appear to have a positive effect on the child, the physician and parent should consider a gradual program of medication withdrawal.

Withdrawal of stimulant medication. The above procedures are appropriate for children who are not currently taking medication to control their hyperactivity. The physician who wishes to reduce or eliminate the medication that a hyperactive patient is currently taking follows a somewhat different set of procedures. First,

baseline data should be collected for two weeks as described previously, but it should be collected while the child is taking full doses of medication. Then a program of gradual medication withdrawal can be implemented following the method used in this study. Medication withdrawal continues until ten to twenty percent increases in hyperactivity are recorded on the School Note and/or Home Behavior Report. At this point, withdrawal should be curtailed and the parents should be referred for class instruction in child management. After parental instruction, medication withdrawal can be resumed until the child is completely withdrawn from medication or a level is reached below which his behavior markedly worsens.

Using the above procedures, perhaps many hyperactive children can be treated without the use of stimulant drugs and those currently on these medications with can be withdrawn by their physicians or reduced to minimal amounts of medication.

Chapter Five

SUMMARY

Hyperactivity is the most common behavior disorder of children today. Depending on criteria, between one and fifteen percent of all elementary school children in this country are considered hyperactive by their parents, teachers, and physicians.

The treatment of choice for childhood hyperactivity is stimulant medication. Medication generally improves performance on selected laboratory measures and on teacher rating scales. However, medication does not improve long term academic functioning, nor observed classroom behavior. In addition, stimulant medications have a long list of side effects, such as insomnia, anorexia, and depression.

Behavior therapy is an alternative treatment to stimulant medication. How well nonpharmacological treatments, such as parental training in contingency management and child instruction in self-control, compare to drug therapy is unknown. No comprehensive, long term, naturalistic studies utilizing multiple dependent measures have been conducted to date. This study was designed to examine the relative effectiveness of medication versus

behavioral tratments for childhood hyperactivity.

Subjects

Eight hyperactive elementary school boys (Grades 2-5) using prescribed stimulant medication were subjects. Screening procedures involving comprehensive parent interviews, school and physician contacts and double blind placebo trials were developed to insure that the children selected were severely hyperactive and that medication was effective in controlling their behavior. The eight boys chosen displayed marked increases in hyperactive behavior on placebo compared to active medication as measured by classroom observations and ratings by parents and teachers.

Subjects ranged in age from seven to ten years old and were of normal intelligence. They had been taking medication for an extended period before entering the study; the range was eight months to nine years. Six boys took methylphenidate (Ritalin) in doses from 10 mg to 45 mg per day. Daily milligram of medication per kilogram of body weight ranged from .32 to 1.48 mg/kg. Two boys took pemoline (Cylert). Their dosages were 37.5 mg and 56.26 mg.

Treatment

The first intervention evaluated was a 48 lesson self-control curriculum for children designed to teach four types of skills: self-direction, motor inhibition, attending behavior and social problem-solving. In each 45 minute lesson, skills were explained, modeled and practiced

by the child using board games, videotapes, audiotapes, worksheets, roleplays, card sorts and quiz games. Homework required the child to use the newly learned skills in his daily life. A reinforcement system was implemented during training to reward the child for task appropriate behavior and the use of new skills.

The second intervention was an eight session, twenty hour behavior management program for parents. In these sessions, parents were taught how to pinpoint problem behaviors, how to increase positive behaviors and decrease hyperactive behaviors, how to use time out, how to develop parent-child contracts, how to use a point system, and generally, how to control their hyperactive child without the use of medication. Each week homework and take home quizzes were reviewed, new material presented and discussed, and homework requiring the use of new skills assigned. Assignments were tailored to the needs of each child.

To insure that both mothers and fathers participated in child management classes, eight checks (averaging thirty dollars each) were collected from each family and refunded weekly, contingent on their completion of assignments. All parents attended all sessions and completed all assignments.

Teachers of children who received treatment were also provided consultation regarding the management of hyperactive children. The frequency varied depending on the request of the teacher; the range of contacts was once per

month to once during the course of the study.

Medication Withdrawal

The six subjects who received treatment were simultaneously withdrawn from medication. An individual reduction schedule was developed for each child to facilitate complete withdrawal by the end of treatment. Parents were responsible for seeing that their child received the appropriate amount of medication each day.

Five out of the six treated subjects were completely withdrawn from medication by the end of the study; an average of 8.4 weeks was needed. One subject was reduced to 33% of his original dosage. His parents decided to increase his medication in the last weeks of treatment.

Design

An intensive time-series design was used to assess the effects of the two interventions relative to drug therapy. Four children received the combined treatment, Self-Control Instruction plus Child Management Classes for Parents. The parents of two additional children attended Child Management Classes only: their sons did not receive special instruction. All children who received treatment were simultaneously withdrawn from medication. Another two children served as delayed treatment control subjects. They participated in all assessment procedures but no attempt was made to alter their usual dosages of medication. These two subjects received treatment after the study was completed.

All eight subjects were observed over an 18 week period: three to four weeks of baseline, twelve weeks of treatment and two weeks directly following treatment.

Experimental control was enhanced by several design features: time lagged treatments, delayed treatment controls, within subject comparisons, and random assignment of the eight subjects to treatment.

Dependent Measures and Data Analysis

Classroom observations using the Hyperactive Behavior Observation System (HBOS) were conducted three days per week for 18 weeks. The total number of observations varied per child, depending on absences from school; the range was 36 to 46 observations. Trained nonparticipant observers recorded the behavior of the hyperactive child and randomly selected comparison boys from the same classroom. Eleven behavioral categories were coded -- nine which assessed the behavior of the child being observed and two which assessed the behavior of teacher and peers toward him. Throughout the study interobserver reliability was measured. Average percent agreement reliability for individual codes ranged from 81.7% to 99.9%. Overall reliability across all codes and all observers was 95.6%.

School Notes comprised of four or five academic and social behaviors that each teacher felt needed most improvement were also completed daily. Home Behavior Reports were completed by the child's parents each evening

and provided frequency data on the ten worst problem behaviors he displayed at home. Data from classroom observations, School Notes, and Home Behavior Reports were analyzed using visual inspection and autoregressive integrated moving average (ARIMA) procedures.

In addition to daily measures, several pre-post measures were administered including the Wide Range Achievement Test (WRAT), the Wechsler Intelligence Scale for Children (WISC), the Matching Familiar Figures Test (MFFT), the Porteus Maze Test, the Coopersmith Self-Esteem Inventory (SEI), and measures of height and weight. These measures were analyzed using analysis of variance procedures.

Results and Conclusions

Treated subjects displayed several patterns of change in observed classroom behavior. Two subjects were successful in withdrawing from medication; their behavior was comparable off medication as it was on full medication. One subject was withdrawn from 75% of his original dosage without significant behavior change. Another subject was withdrawn from 66% of his dose without change. This subject might have been able to reduce further, had his parents allowed reduction to continue. The last two subjects were withdrawn from 50% of their medication without deterioration in classroom behavior; their behavior worsened with less than 50% of their medication. Control subjects who remained on medication for the duration of the study showed no

changes in hyperactive behavior at school. However, the medication of one control was increased to 200% of his original dose during the study. School Note data generally corroborated classroom observations.

Subjects displayed different responses to treatment on Home Behavior Reports compared to measures taken at school. With behavioral treatment, three subjects became significantly less hyperactive at home off medication than on medication. The other three subjects were withdrawn from various amounts of their original dosages without displaying significant deterioration in their home behavior: one from 75%, one from 66%, and one from 50%. Subjects for whom behavioral treatment was most successful in controlling hyperactive behavior at school were not necessarily the same children as those who showed the greatest improvement at home. The home behavior of children who received medication but no additional treatment (delayed treatment controls) changed minimally over the 18 week study.

Contrary to expectation, there was no evidence that self-control instruction for children added to the effects of child management classes for parents. It was hypothesized that this result might be explained by the lack of systematic external reinforcement for using self-control in the child's natural environment.

This study found no significant differences between treatment and control subjects on most of the pre-post

measures. The only exceptions were 1) the two subjects whose parents received the child management only treatment improved signficantly in WRAT Reading scores over the other subjcts and 2) treatment subjects lost significantly less weight during the study than did the two control subjects. These results are considered highly tentative, however, given the small sample size.

A summary of the time-series and pre-post results indicated that all children responded in a highly individual manner on the multiple dependent measures used in this study. No personal or family variables consistently predicted their pattern or direction of response. Case studies of four of the subjects are presented to illustrate the extreme variability in the hyperactive child's medication history, family situation, response to medication, and the effects of behavioral treatment.

Results of this study suggest that behavior therapy is an effective alternative to drug treatment for a significant proportion of hyperactive children. A procedure for the medical management of childhood hyperactivity which involves the use of behavioral treatments is described.

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